FURTHER RESEARCH AND CONTROL OF SEA LAMPREYS OF THE GREAT LAKES AREA

HEARINGS

BEFORE THE

SUBCOMMITTEE ON THE FISHERIES AND WILDLIFE CONSERVATION

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

EIGHTY-SECOND CONGRESS

FIRST SESSION

ON

H. R. 2995

A BILL TO AMEND THE JOINT RESOLUTION OF AUGUST 8, 1946, AS AMENDED, WITH RESPECT TO APPROPRIATIONS AUTHORIZED FOR THE CONDUCT OF INVESTIGATIONS AND STUDIES THEREUNDER

APRIL 30, 1951

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FURTHER RESEARCH AND CONTROL OF SEA LAMPREYS OF THE GREAT LAKES AREA

MONDAY, APRIL 30, 1951

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON FISHERIES AND
WILDLIFE CONSERVATION OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D. C.

The subcommittee met at 10 a. m., the Honorable Frank W. Boykin (subcommittee chairman) presiding.

Mr. BOYKIN. The committee will come to order.

The committee this morning will hear testimony on H. R. 2995.

(The bill referred to is as follows:)

[H. R. 2995, 82d Cong., 1st sess.]

A BILL To amend the joint resolution of August 8, 1946, as amended, with respect to appropriations authorized for the conduct of investigations and studies thereunder

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the last sentence of the first paragraph of the joint resolution entitled "Joint resolution authorizing and directing the Director of the Fish and Wildlife Service of the Department of the Interior to investigate and eradicate the predatory sea lampreys of the Great Lakes", approved August 8, 1946, as amended, is hereby amended to read as follows: "The cost of the investigations and studies authorized in this section shall not exceed $359,000 for the first year, $216,000 for the fiscal year ending June 30, 1951, and $500,000 for each of the five succeeding fiscal years.".

Mr. BOYKIN. We have with us Congressman Charles Potter, and we are glad he is here. I think that it would be best to let Mr. Potter tell us all that he wants to about this. The witnesses are his.

Mr. Potter, you may present them as you see fit.

STATEMENT OF HON. CHARLES E. POTTER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. POTTER. First, I wish to thank you and the other members of the committee for affording me this opportunity of holding hearings on this meritorious piece of legislation.

Mr. BOYKIN. Mr. Potter called me last Friday, and I told him that we would make the hearing any day except Sunday.

Mr. POTTER. It is a distinct pleasure for me to be back with the committee. It is like Old Home Week. I have a tinge of regret that I am not still on the committee, particularly if I had known that I could serve under the capable and well-informed chairman.

As you will recall, we passed the original legislation to carry out a research program in an effort to determine means of controlling the sea lamprey, which is a parasite that has been running wild in our

Great Lakes and has practically destroyed a multimillion-dollar fishing industry.

Mr. BOYKIN. Multimillion?

Mr. POTTER. Yes, multimillion.

The other witnesses, I am sure, will be able to expand upon that in more detail than I. I do not plan to give you the technical details because, in the first place, I do not have them, and, in the second place we have people who do.

I do want to take this opportunity to express my appreciation to the personnel in the Fish and Wildlife Service who have carried on and worked at this research program. I think that we are most fortunate in having men such as Dr. Jim Moffett and Dr. Hile and Dr. Vernon Applegate, who have put in an immense amount of time, more than they would be required to under normal circumstances. They have worked without thought of quitting time, and so forth. That has held true through all the personnel that I have had any contact with that have been working on this problem.

One of their control programs is not far from my home town, and reports have come to me that these men are working 6 and 7 days a week without overtime and without griping, which we would normally expect from people working under those conditions.

I do want to take this opportunity to inform the committee that here is a Government agency that I believe has done a grand job, particularly in the work with this sea lamprey research program.

The purpose of this legislation, Mr. Chairman, is to increase the authorization so that they can do their job faster than they are now able to do it under existing authorizations.

The witnesses that will follow will justify the reasons for this additional authorization, and I will not attempt to go into that at this time.

I wish to thank you again, Mr. Chairman, for your cooperation. If you will bear with our other witnesses, I am sure that they will fully explain and define what their program is at the present and what they propose to do in the future.

Mr. HAND. I would like the gentleman to refresh my memory on the appropriation previously authorized in the legislation in 1946. What was the previous authorization?

Mr. POTTER. The authorization was for $216,000 a year. For the first year the authorization was for $359,000, with a $216,000 annual appropriation.

It might be interesting to note, as you will recall, this legislation was passed during the early fall, I believe, and the Fish and Wildlife Service never used a large portion of the first year's allotment because they could not use it judiciously because of the lateness of the year I think that is to their credit.

Mr. BOYKIN. I imagine that they had to find out how to use it.

Mr. POTTER. That is right; they did. The work they have done so far has given them a pretty good idea of what is necessary to get some definite conclusions.

Mr. TOLLEFSON. This bill just simply increases the amount of the authorization which was mentioned in your legislation of the Eighty-first Congress?

Mr. POTTER. That is correct.

Mr. BOYKIN. How much does your bill call for?

Mr. POTTER. For $500,000 a year for the next 5 years.

Mr. BOYKIN. And Mr. Day will tell us what that will do?
Mr. POTTER. Yes.
That is all that I have. I think that Mr. Day would like to testify.
Mr. BOYKIN. We will now hear from Mr. Day.

STATEMENT OF ALBERT M. DAY, DIRECTOR, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. DAY. Mr. Chairman and members of the committee, it is very pleasant to have an opportunity to come back and visit with you people again. We have not bothered you so far this session, and we hope we will not have to bother you a great deal for the remainder of the year.

Our legislative program is in very good shape, thanks to the interest and cooperation of this committee.

Mr. Chairman, it is my understanding that this hearing has been called for the purpose of considering the present status of the sea lamprey as a menace to the important commercial and sport fisheries of the Great Lakes and for the purpose of informing yourselves as to the progress made by the Fish and Wildlife Service in developing means of combating this threat. Part of your purpose, I assume, will be to secure information bearing upon H. R. 2995, a bill to amend the original authorization of August 8, 1946, under which the Fish and Wildlife Service initiated the studies. It was indicated that the subcommittee is desirous of hearing from the men who are actually engaged on the lamprey-research program in the field, and Dr. James Moffett and members of his staff are here to present to you the detailed facts and figures which only they can provide. I am heartily in accord with the idea of devoting the greater part of the Fish and Wildlife Service testimony to the statements of these fieldmen in preference to hearing from those of us in Washington who could only provide you with second-hand information derived from the reports of the field studies. For this reason, I shall confine my remarks to a very few and brief high lights.

It has become increasingly evident that our earlier speculations as to the seriousness of the sea-lamprey menace were not the cries of alarmists. The sea lamprey has extended its threat, both geographically, by migration into new areas, and numerically, as will be shown in the records, by greatly intensified runs in Lake Huron, Lake Michigan, and Lake Superior. This extension has apparently been reflected in new depredations upon species which were relatively untouched a few years ago when the number of sea lampreys was much less. I shall not attempt to anticipate Dr. Moffett's testimony by going into details of the work that has been done to demonstrate this.

One of the basic studies which I would recommend to your attention is Special Scientific Report No. 55, entitled "Natural History of the Sea Lamprey in Michigan," which brings together much of the current knowledge of the characteristics of this pest.

It is a rather large volume that has come out of the research studies since this study has started. It is a well-documented study.

Mr. POTTER. Is that Vernon Applegate's report?

Mr. DAY. Yes; Vernon Applegate's, containing the general information on the whole program.

Such information is, as I have said, basic to the next step of devising control measures. In planning for these control measures, our staff has overlooked no possible methods. Contracts have been entered into with qualified engineering firms for the purpose of testing electrical methods of control. The designing of physical barriers to the migrating adults has been an important part of the program, and consideration has been given to biological methods of control. These are the technical details and I should like to leave further discussion on these technical points to the men who have lived with the problem for the past 2 years.

As more facts have brought recognition that the threat to the fisheries is so grave, they have likewise brought recognition that the cost of control is potentially staggering. When the Fish and Wildlife Service recommended to the Congress, in connection with the original authorizing legislation, certain sums as requisite for the job as we then visualized it, we were acting in the light of our best knowledge and judgment at that time. It was the intention to carry on the work at a minimum cost and we did not come in with any inflated figures. It is now evident that we set out sights too low. In testifying before the House Appropriations Subcommittee on the Interior Department appropriation bill for the fiscal year 1952, I made the following statement:

> We can trap them, kill them. We have even been developing electrical devices, electronics, to see if we can kill lampreys without killing some of the other fish that also spawn in shallow waters. It now seems as though we can control them, but it is somewhat like building screens on all the houses in the United States to keep out flies or mosquitoes. It can be done but the cost is going to be absolutely terrific.

I still do not know what it will cost to devise workable, practicable methods for controlling the sea lamprey. Please note that I say "control" because I do not honestly believe that we can eliminate the animal. I think the best that we can hope for is to reduce the numbers so that they will not constitute any serious handicap to the application of whatever other measures may be necessary to restore and maintain the fisheries of the Great Lakes.

The Service has prepared a report upon H. R. 2995 which is in the process of being cleared through the Department and the Bureau of the Budget. Pending review by these agencies, I am not in a position to present a specific recommendation upon H. R. 2995. However, I maintain my previous statement that added funds will be necessary to carry out the purposes contemplated under the original joint resolution of August 8, 1946.

Throughout this problem there runs a question which will ultimately have to be decided by the Congress. We are confident that the research and investigations will lead to concerted recommendations which if applied will reduce the threat of the sea lampreys to a level where it is nowhere as serious as it is now. As I have said, this will cost money. This brings up the question as to whether the application of these control measures and the payments of the costs thereof should properly be a responsibility of the Federal Government or of the States, or on some joint basis representing a contribution by both. Since we are not yet in a position to undertake full-scale, all-out, comprehensive control, pending the perfection of methods and equipment, the question does not call for a solution at this actual moment,

but it will require an answer before too long. I should be grateful for some indication of the thinking of the Congress on this policy question in order that the Fish and Wildlife Service can lay its budgetary policies accordingly. I am honestly unsure as to where the responsibility for the outright control program should rest. I do have this conviction, however—that there must be some degree of Federal participation because of the fact that the problem is international. Sea lampreys respect no international boundaries, and control must be applied in Canada as well as the United States if it is to be effective. Because of this international aspect, I can see no alternative to some measure of Federal participation in the final control program.

In conclusion, let me say that I have been gratified and encouraged by the vigor and intelligence which have been displayed by the biologists and other field staff members of the Fish and Wildlife Service and by the interest and assistance which the affected States have shown. I want to give full credit to the workers in the field who have been unsparing in their efforts and whose activities have been under close scrutiny of the fishermen and the local people in the fishing areas. I really believe that these local citizens will join with me in commending the efforts of our staff members. I want the credit to rest with them, where it fully belongs. I should now like to relinquish the witness stand to those of our staff members whom the chairman may wish to call.

Mr. BOYKIN. Any questions?

Mr. ALLEN. I was interested in your request for a statement of our thinking. It has seemed to me that we have had an unbalanced support program for foods, as between agriculture and fish products.

My recollection of the Senate document, I think of the Seventy-ninth Congress, is that there was 84 cents a ton of Federal expense for fishery products and $7.02 a ton for agricultural products.

Recently one committee knocked out an appropriation for something over $300,000 which had to do with the international support of the Tuna Commission.

Is there any over-all program under which we should support all fisheries some amount of money on a per-ton basis, or on a proportion of the value of the catch which should be integrated as a program for the fisheries of the Nation as a whole, out of which would come a proportion of the fisheries of the Great Lakes that would be in line with the support given to the other fisheries? I do not know that I have made my inquiry clear, but do you get the field into which I would like for you to delve?

Mr. DAY. There is now pending a bill which would provide fishery subsidies similar to agricultural subsidies, an authorization for, I believe, some $3,000,000. So far fishing legislation has all been aimed at a specific problem such as this that we have before us today, and such as the Tuna Commission has. We have never had an over-all authorization that would cover all the fishery products or problems. I do not know that our budgetary people would look with favor on it. It is something that I think we should consider. It is a very broad question that you have posed.

Mr. ALLEN. Have you ever broken down the figures on the support given to various species of fish so as to know what the Federal contribution per ton of fish produced has been, by species?

Mr. DAY. Yes; I think that we have that in our files. It was undoubtedly broken down by species in order to arrive at this original figure quoted in those previous hearings, so I think that that figure would be obtainable.

Mr. HAND. Where else are lampreys in quantity that constitute a problem other than in the Great Lakes?

Mr. DAY. That is the only place.

Mr. HAND. Are they a potential danger elsewhere?

Mr. DAY. Possibly.

Mr. HAND. That is highly speculative, I assume?

Mr. DAY. Possibly. If they were introduced into other large bodies of fresh water, they would undoubtedly take hold. So far they have been confined to the Great Lakes watershed. I think I am correct in that statement. If not, someone can correct me.

Mr. HAND. They inhabit fresh water entirely?

Mr. DAY. So far, yes. The ones that are a problem are in the fresh water in the Great Lakes.

Mr. HAND. What States are affected?

Mr. DAY. All the States surrounding the Great Lakes are potentially affected. At the present time it is Ohio, Wisconsin, Michigan, Minnesota, Illinois, Indiana, New York, and Pennsylvania, with Ontario on the north.

Mr. HAND. There have not been approaches yet to the Dominion?

Mr. DAY. The Dominion has been doing work for some time, although not as extensively as the United States.

Mr. HAND. Is there cooperation between the two?

Mr. DAY. The fellows in the field have been correlating their programs.

Mr. HAND. I think you suggested this in your testimony, but has there been any thought given as to any regional cooperative efforts on the part of the States affected, either with or without the help of the Federal Government?

Mr. DAY. It has been developed on a cooperative basis recently, the States of Wisconsin and Michigan. Those two States have been contributing funds, personnel, and technical know-how in order to get the program started. The Federal Government, however, has carried the major share of the costs so far.

Mr. HAND. Are you prepared to say what funds have been contributed by the States, and in what manner?

Mr. DAY. I am sure that Dr. Moffett can answer that question when he takes the stand.

Mr. ALLEN. Is there any move on the part of the States bordering the Great Lakes to form a commission similar to the Gulf, the Atlantic coast and the Pacific coast commissions, to treat jointly their fishery problems?

Mr. DAY. There has been pending for a period of years a proposed international agreement for the Great Lakes between Canada and the United States. It has been effectively stymied, if I may use that word, by opposition from the State of Ohio.

Mr. HAND. What is the basis of Ohio's opposition?

Mr. DAY. They are fearful that the Federal Government would move in toward controlling what is considered to be a State problem.

Mr. HAND. Do we have any regional set-up such as the North Atlantic Commission?

Mr. DAY. No. At the present time there are regional organizations, interstate compacts, completely surrounding the United States ocean waters. The Atlantic compact takes in everything from Maine to Florida. The Gulf States compact takes in everything from Florida through Texas, and the three Pacific Coast States have an interstate compact in which the Fish and Wildlife Service works in conjunction with all of them. The Great Lakes treaty has never been effected.

Mr. HAND. There is nothing analogous in the Great Lakes area.

Mr. DAY. No. There should be.

Mr. HAND. Has there ever been any thought or theory as to the fishing industry bearing a portion of the cost of any sort of work of this character—not just this, but any other sort of work—by some sort of tax or assessment on the value of the product?

Mr. DAY. In some places the fishing industry does that very effectively. In the State of California the pilchard industry contributes through an assessment of 10, 15, or 20 cents a ton, which brings in something like $200,000 a year to be used cooperatively with the Fish and Wildlife Service program, and other State funds are carrying on a rather extensive research program.

In the Alaskan field, the Alaskan salmon industry, through funds which they raise from their industry, carry on research.

Those are the two outstanding cases that come to my mind immediately.

Mr. HAND. It comes to my mind rather interestingly that many of the commercial fishing interests in my own area have recently, on an entirely private enterprise basis, voluntarily assessed themselves on the value of their property, not for the purpose of fish research, but for the purpose of building funds whereby persons injured in the course of pursuing fishing, or even other maritime enterprises, can be hospitalized out of the joint fund. It is a rather interesting idea, and I wonder how much the industry in other areas has been banded together to at least participate in research, as in this case, to prevent themselves from being knocked out of the market entirely.

Mr. DAY. Outside of those two cases I do not recall any others. Those are the two major instances.

In general, the fishing industry has been looking toward the States and the Federal Government to carry on their basic research for them.

Mr. TOLLEFSON. Mr. Day, you have indicated by your statement that the problem of controlling the sea lamprey is a very difficult one.

Mr. DAY. That is correct.

Mr. TOLLEFSON. It is not a hopeless one, however, is it?

Mr. DAY. No. It is more encouraging now than it was 2 years ago, when we started this work.

Mr. TOLLEFSON. In other words, the work that has been done thus far indicates that the chances of success are greater, shall I say, than you thought they were originally?

Mr. DAY. I think that is a fair statement, Mr. Tollefson.

When we originally started out on the program, before there was too much basic research on it, we assumed that the lampreys would spawn in almost any side stream of the Great Lakes. We are finding out now that they have rather specific requirements. Their requirements for spawning are similar, let us say, to trout. They have to have an optimum temperature of water and certain types of gravel beds, so

certain streams, or side streams, are going to be eliminated from the necessity of control measures. I think that we are finding definitely the problem can be met; in fact, it is more encouraging now than it was when we started.

Mr. TOLLEFSON. Representative Potter called this a multimillion-dollar fishery. He did not cite any figures, and I am not going to ask you to, either; but I think one of the things that our committee will have to consider will be the relationship of the cost to the value of the fishery that we are endeavoring to save.

The bill authorizes the expenditure of $500,000 per year for this work. Do you think that sum is justified in relation to the value of the industry?

Mr. DAY. Oh, yes; I think there is no question about the $500,000 figure being justified. That is purely for rounding out the research, for putting in more weirs, testing more electronic devices, and carrying the research program through to the point where we can definitely recommend an action control program. I think when it comes to that point we are all going to have to take a careful look at it and estimate the ultimate cost of the control measures. This so far is just trying to find the means of doing an effectual job. I think there is no question but that this is fully justified to carry on the research more expeditiously and on a more scientific scale.

Mr. HAND. Does the sea lamprey have any use whatever?

Mr. DAY. No practical use.

Mr. BOYKIN. Fertilizer?

Mr. DAY. It could make fertilizer.

Mr. BOYKIN. What do you know about them? Had you not better tell us a little about them? Can they live in salt water?

Mr. DAY. Originally they came from salt water. They were effectively stopped at Niagara Falls, but the so-called Welland Canal permitted them to come in from the ocean, and they have changed their original habits from a salt-water species to a fresh-water species. Their original home was in salt water.

I think, before getting into the details, I would prefer to let some of the people who know more of the life history answer your questions.

Mr. BOYKIN. We will now hear from Dr. James Moffett.

STATEMENT OF DR. JAMES W. MOFFETT, CHIEF OF THE GREAT LAKES FISHERY INVESTIGATION FOR THE FISH AND WILDLIFE SERVICE

Dr. MOFFETT. Members of the committee, my name is James W. Moffett, and I am chief of the Great Lakes fishery investigation for the Fish and Wildlife Service.

I want to express our deep gratitude for the opportunity to appear before you and present this problem as it now stands, and also what we consider a possible justification for increased tempo in our research work.

The sea lamprey, as has been already said, entered the Great Lakes through the Welland Canal, found fortuitous circumstances in Lake Erie, where normally the situation is not too good for sea lampreys, made its way into the Detroit River and from there into Lake Huron.

After it reached Lake Huron it found a situation very much to its benefit, and it mushroomed very rapidly in a manner which might be called similar to the mushroom of the English hare in Australia.

The sea lamprey was removed from its original environment where all the agents affecting its abundance had a chance to influence it. It left behind its enemies and took up this new existence and found there a backlog of food material which gave it an impetus that we seldom find in the usual biological field.

It spread very rapidly throughout Lake Huron, very rapidly into Lake Michigan, and it is now increasing in Lake Superior.

If you will permit me to place some charts before you, they will illustrate what the sea lamprey has done to the lake-trout production in these various Lakes.

This chart [indicating] illustrates the catch in millions of pounds. in Lake Huron, in 1935, the lake-trout catch was worth approximately $700,000.

Mr. HAND. May I ask you from what source these figures are derived?

Dr. MOFFETT. Those figures are taken from the statistics on the fishery which are required of all fishermen by the various States involved. The States have for quite some time turned over to us their statistics for further analysis.

I might add this involves only United States waters and not Canadian waters.

The catch was approximately worth $700,000, or valued at $700,000 in 1939, and in 1949, $500.

Mr. BOYKIN. It is practically all gone?

Dr. MOFFETT. Practically all gone. There are lake trout there, but the population is below the practical commercial level. It does not pay to put forth the effort, and the returns are too small.

In Lake Michigan the decline was much more spectacular because the population was larger before the lamprey got to work on the trout in Lake Michigan.

We give here the statistics from 1936 through 1949 [indicating], and you will note that from 5,000,000 to approximately 7,000,000 pounds was the normal production in Lake Michigan. At that time, during the peak period, the lake-trout fishery was worth approximately $3,000,000 a year. This, incidentally, is calculated on the basis of 50 cents a pound, which existed during those years; and, on the basis of present standards of lake trout selling at 70 cents a pound, you can add two-fifths to the value.

At the present time in Lake Michigan the catch has gone down, and by 1949 it had gone down to $172,000 in value.

Mr. HAND. Wholesale or retail prices?

Dr. MOFFETT. The fisherman's price right at the dock.

Mr. HAND. I am astounded at such prices.

Dr. MOFFETT. Dr. Hile will illustrate the Great Lakes fishery in terms of value, and I am sure that he will outline it for you.

Mr. HAND. In 1935 you could buy a T-bone steak for that price.

Dr. MOFFETT. Lake trout has always been what you might call a specialty fish.

In Lake Superior the production has gone on approximately in normal fashion. The green line on this chart [indicating] represents the production over the years from 1929 to 1949. It has varied some, but only naturally. The red, long-dashed line is the intensity of effort, the amount of fishing gear used. It goes up and down with the production and has been quite normal in its characteristics.

The short-dotted red line represents the relative abundance of lake trout found in Lake Superior. As an indirect effect of the loss of lake-trout stocks in the last two lakes mentioned before—Michigan and Huron—the condition in Lake Superior, because of increased pressure—and you will notice that this effort line is way up; the intensity is terrific; they are fishing as much as 15 miles of gill net per fisherman per day—the intensity has gone way up, the production has remained approximately the same, and the abundance of the lake trout is going down as the years go by.

In this instance we cannot say for sure whether the lamprey is at fault or whether it is the drastic effort that is being put into the fishery at the present time.

This is especially dangerous because it takes so much more time and effort on the part of the fishermen to get the same pounds of fish at this point [indicating] as it did at this point [indicating] when the fishery was normal. Anything superimposed upon that condition can be rather dramatically disastrous, if I can use such a term.

It will crash very suddenly once it starts to break.

That, gentlemen, I think, answers your question about the relative value of the fishery.

I may add that the lake trout is not the only species suffering. The white fish of Lake Huron is practically gone, and we are forced to import more and more of those varieties, white fish and lake trout, from Canada; and those products come from the far northern lakes in Canada—the Great Slave and the Great Bear—and the products are of very poor quality.

Our effort in regard to the sea-lamprey-control investigation is illustrated by this chart. We use these charts for sportsmen's shows and commercial fishery meetings and other gatherings where the interest is very high, where they want to see what is going on and we cannot afford to have a staff there to explain.

We did not make these up especially for you. They have been shown to sportsmen's groups and national fishery conventions from Chicago clear around the Great Lakes at various times.

We now use three basic types of weirs. We use a small-stream weir that can be placed in tiny streams. It is portable and can be taken in and placed with ease and then taken out with ease.

We use the next size, which is a more or less fixed affair. It cannot take too much water, but it works very well in smaller and medium-size streams.

Then we use a very large weir, and this picture shows the one that we use in the Ocqueoc River, which costs something like $13,000 to build.

Mr. BOYKIN. How many lampreys have you caught?

Dr. MOFFETT. Last year 26,000 adults in the larger weir.

In order to study the little fellows going downstream, we use a weir like this [indicating]. It is essentially a spill-over dam. The dam has a lip on it, and all the water drops through a set of screens which are small enough to hold the little fellows as they go downstream to the lake to take up a parasitic existence. We can rely fairly well on these physical barriers. Our major trouble there is cost and maintenance. They will work, but their unit cost is relatively high, and the maintenance is really terrific. When we have floods during the period of migration, it is almost essential for a crew of two to work almost constantly

on the larger weirs to keep them free of debris. That means, if we work the men 8 hours each day, we would use six men per structure. We have figured it out on the basis of what we know about Michigan streams and Wisconsin streams, and we believe that it would be economically feasible to tackle the problem with that equipment, but we feel that is not the final answer and we should explore and refine our methods so that we can get at something more economical.

Major efforts in that respect have been in three directions—two mainly. The first direction, the use of electricity as a means of killing, actually killing, the downstream migrants, the ones that go downstream to take up a parasitic existence. Our purpose there is to effect an immediate control. If we can kill those lampreys going downstream before they parasitize fish, we have an immediate control.

Last winter our contractor, the Cook Electric Co., a group of electrical engineers, joined with us in operating the first phase of our study. They found, while working with this weir right here [indicating], this drop through screens that I told you about, as a control, a point we could check; they found that it took approximately 100 watts of power per cubic inch of stream flow to kill 80 percent of the downstream migrants in 8 seconds. That, obviously, was an uneconomical procedure.

Mr. BOYKIN. How about the other fish?

Dr. MOFFETT. It would kill all the other fish as well. You can kill fish with much less electricity than lampreys.

Mr. BOYKIN. Suppose that you could find something that would kill a hundred percent?

Dr. MOFFETT. The device will kill 100 percent of the lampreys; but, in order to get an 8-second exposure to this electrical field, we have to put an electrical field across the stream flowing 3-feet per second, which is 24 feet in depth, and that requires a tremendous amount of energy. The power bill would run approximately $240 per hour for a stream 24 to 30 feet wide.

In doing this phase 1 work, however, we developed the background for our phase 2 operation which is now being put into effect near the Ocqueoc River weir. The first two operations are to stop the adults going upstream to spawn, by the use of electricity; not necessarily are we interested in killing the adults going upstream to spawn. We are able to do that with much weaker potentials, and I feel that will be more promising. However, we cannot make any commitment on that until we have had the time to study, to go on with the study, which will possibly terminate during July. By that time we should have some rather basic information on what we can do in the matter of selectively stopping lampreys and providing means for leading fish along certain electrical currents. You can lead and dissemble fish. The Germans and some of the others in Europe have now used that device as a means of fishing. They do not use nets except to gather the fish up. They assemble them with a certain type of electric current. We expect to use that as a means of assembling the fish migrating at the same time as the lamprey, put them in a bypass, run them around the electrical barrier which would ordinarily stun them, and then stun the lampreys so that they cannot go any further.

We have the advantage in this phase 2 deal of having the stream current in our favor. The lampreys have to oppose the current. As soon as their voluntary actions are taken away from them, they nat-

urally go back downstream. In the phase 1 work, where we were trying to kill the little ones, we would stun them and they would lose their voluntary action, but they would still continue to go in the direction in which they were headed, out to the lake.

We have also a study under way attempting to find some larvicide. We are treating a great many compounds of the highly complex characteristics that are used on agricultural pests, and other pests, in an effort to find something specific to apply to the lamprey situation. We have some very promising leads there.

We have been able, with some compounds, to kill the lamprey larvae under experimental conditions, while goldfish, our test animal, were apparently unaffected. This is still in a highly experimental stage, and we have not tried the use of chemical warfare on the lamprey population yet in the field, but it is one of the things we ought to be able to do within the limits of an increased authorization.

Mr. BOYKIN. Getting back to that chart, the one that showed where the value ran down from $700,000 to $500, would it not pay to kill everything in there and start over and fix it so that could not get back in?

Dr. MOFFETT. Everything in the lake, sir?

Mr. BOYKIN. Yes.

Dr. MOFFETT. The logistics of the problem would be tremendous. I am not stealing some of Dr. Hile's thunder, but in the Great Lakes we have 92,000 square miles of area.

Mr. BENNETT. The lampreys will do that for you.

Dr. MOFFETT. That is true, and without any effort on our part the lampreys would become reduced in number because they would eat themselves out of house and home.

Mr. BENNETT. Do they eat each other?

Dr. MOFFETT. No.

Mr. BENNETT. Are you making any effort to bring in any of the enemies that are in the natural salt waters?

Dr. MOFFETT. Yes. We have found by preliminary experimentation that the ordinary eel, the American eel, that is not related to the lamprey at all, the American eel in fresh water will eat lamprey larvae. We have done it in tanks and found that without any other food the American eel will consume practically all of the larvae present.

We have in our plans an experiment where that is done in larger areas where we have fish present, as well as the sea lamprey, to find out if there is any preference between the two. We do not know the American eel will eat fish. Now, maybe if the fish are there and the lampreys are there too, the American eel might prefer the fish. We are going to get our supply of American eels from New York State possibly this spring. The life history of the American eel makes it a fairly decent animal to use because it cannot reproduce in fresh water. It has to go to the sea to lay its eggs, so if we catch them from streams entering the ocean just as they come back from the ocean as little fellows, and introduce them into our fresh water, we can be sure that they will survive only during their life history.

Mr. BOYKIN. How long is that?

Dr. MOFFETT. They can live sometimes as long as 20 years.

We are trying through this pilot experiment to find out what harm they can do. They have been known in England to eat trout and salmon in their streams.

Mr. BENNETT. Are there any diseases which we could get started on them?

Dr. MOFFETT. The lampreys have several parasites, worms, and so on, but they do not seem to be bothered by them very much. I have talked to bacteriologists who are interested in developing these highly potent strains of bacteria which would normally kill off all our food, and so forth, and they say that there would be no difficulty at all in developing a strain of bacteria specific to the lamprey, but once it was out of control, that is released in the lake, those bacteria are liable to be mutable; in other words, they can change their heredity so readily that we might have something worse than the lamprey to contend with, in the long run.

Mr. BOYKIN. What has happened to these other people that have been troubled with the problem, Canada, for instance? Have their waters been ruined altogether?

Dr. MOFFETT. Lake Ontario is a good example of a lake in which the lampreys have occurred naturally for a long time. Their fish production, considering the area of water available, is very low. Although the lake is very suitable for trout, the trout production is very low. It is balance between the take of the lamprey, the commercial fishermen, and the productive capacity of the water in question.

Mr. BOYKIN. Do we have any other fish there than trout that they do not bother?

Dr. MOFFETT. We have not found any fish in the Great Lakes that the lamprey will not chew on except possibly a few of the minnows and the smaller life history stages of the larger fish before they grow up.

Mr. BOYKIN. What is the size of the lamprey?

Dr. MOFFETT. These [indicating] are characteristic specimens [showing a bottle]. This is an adult. In the Great Lakes they will run approximately 16 to 20 inches in length. In the sea they will run up to 30 inches in length. These are some specimens that were brought in for your inspection.

Mr. BOYKIN. How many will one of these kill a day?

Dr. MOFFETT. That is something highly variable. We have been raising lampreys in our tanks at Hammond Bay in the laboratory to determine the poundage of food required to bring a lamprey to adulthood and spawning condition. That has not yet been completed. It takes about 12 to 17 months to do the job, but it is evident that the demand is very high. We use seven shallow-water trap nets during the winter to catch food for the lampreys we have in the laboratory, and it took the total catch of the seven traps during the winter to feed them. They were mainly suckers and perch.

Mr. BOYKIN. How does a lamprey kill a trout?

Dr. MOFFETT. The lamprey has a sucking mouth. This is a picture [indicating] of the lamprey mouth.

The mouth is very well equipped with teeth, as you can see. At each one of these points [indicating] are sharp teeth, and in order to finish the job he has teeth in his throat, a row of teeth just above his throat.

This is the characteristic mark left by the sea lamprey. You can see the scars shown on this photograph.

Mr. BOYKIN. He cuts it, but does not kill?

Dr. MOFFETT. He cuts through the tissue with his teeth, and sucks the blood. This is an enlargement of the picture, which will give more detail of the types of the scars.

The lamprey is something like the mosquito in that regard. He has a high potential coagulin solution in the saliva gland, and when he gets hold of the fish it lets go and dissolves in the tissue in a way to keep the blood so that he gets more or less permanent supply until the fish runs out, depending upon the individual fish or the individual lamprey, and we have known of them killing fish in a very short time of 1 hour, and it is especially rapid when the lamprey is able to grab the fish in the throat area near the gill; apparently it is able to cut through the heart and bleeds the fish.

Mr. BOYKIN. It must be a pretty fast fish to catch a trout?

Dr. MOFFETT. It has a sneaky method of getting it prey. They are not an especially fast fish, but by observation you can see the lamprey moving around in schools of fish, not really noticed by the fish, and not seeming to bother the fish, when all of a sudden they just turn their mouth on the fish, make a grab and stay there. The fish goes through all kinds of gyrations to try to shake the lamprey off, and sometimes the large fish can do so. Sometimes they get on rocks and try to scrape them off, but they stick their teeth rather deep and rather effective in holding on, and the fish cannot shake them off very readily.

Mr. BOYKIN. How long have you known about these lamprey?

Dr. MOFFETT. They entered the Great Lakes, we have public records indicating, in 1921, and were found by the Canadian fishermen in the western area.

Mr. BENNETT. In 1921?

Dr. MOFFETT. Yes.

Mr. BENNETT. How long since was the canal opened up?

Dr. MOFFETT. The Welland Canal has been in existence for 100 years or more and it has been in use a great deal of the time, during which time it has been enlarged.

One of the ideas we have in mind in the use of this additional money which we suggest, which we hope will be forthcoming, is to develop ways and means of scraping the bottom of vessels, because we know they travel on the hulls. If we ever realize the St. Lawrence waterways we will certainly have larger areas from which they could be reintroduced into the Lakes, and one of the purposes would be to develop some device, some method, of cleaning the hulls as they go through the locks.

Mr. BOYKIN. To take them off the hulls while the vessel is going through the lock?

Dr. MOFFETT. Yes.

Mr. BENNETT. It is thought that these lampreys came into the Lakes by that means from the sea?

Dr. MOFFETT. That is highly likely. Also we feel we have had introduction from the Welland Canal into Lake Erie over in this area [indicating]. The streams contribute relatively warm water, which the lamprey do not like; and the streams are less gradient, and quite muddy, and over on the Ohio side, on the United States side, a good many of the streams are blocked by dams and the lamprey cannot use them. They negotiated Lake Erie, probably, but it was necessary for them to have some ground to successfully spawn in. Given 1

or 2 years of relatively subnormal temperature, and that could be brought about by the different streams where there may be a difference of 20 degrees in the water and the Lake, and if we have just about 5 or 6 degrees lower temperature during any one year, that is satisfactory.

Mr. BENNETT. I understood you to say that lamprey do not like warm water?

Dr. MOFFETT. No, they do not.

Mr. BENNETT. But you say the drop in temperature would not be better?

Dr. MOFFETT. The streams having a lower gradient, the streams will have on the average, a base temperature over the years, they have a relatively maximum range, and a relatively minimum range over the years, but we would have a climactic cycle in which the maximum would not get just quite as high and in which the minimum gets a little bit lower, but in which the average, instead of being at this range [indicating] would slip down about three or four degrees, and the lamprey is so closely related to the temperature in their requirements, that a slipping down of three or four degrees he can use the stream, particularly when it does slip down where he does not use the stream.

Mr. BENNETT. Yes. If the temperature runs up to what you said the lamprey does not like, the warm water, but if the temperature drops down as you indicate he can use it?

Dr. MOFFETT. With the drop in the average temperature.

Mr. BENNETT. Yes.

Dr. MOFFETT. Now concerning this business about the saliva gland: One of the problems we now have is to determine what that anticoagulin is that is in the saliva gland and whether or not it has any application to medicine. This project is just now being gone into seriously, and we have made preliminary contacts with the Ohio State University and with several other universities to see if their medical schools might not care to take some of this material and test it as to possible application for surgery and other types of medical use.

Then we have another project we are carrying on, which we are doing in cooperation with the University of Wisconsin, to find out how the lamprey finds its prey, to test the lamprey, to see if he uses his eyes or his sense of smell or some other method to find the fish that he sets on. That is still going on. There are no results to be reported yet.

We have one other project, at Cornell University, where a man is studying the life history and characteristics of a lamprey of similar species that has existed for a great many years in the Finger Lakes of New York. We want to find out why the lamprey in the Finger Lakes has not eliminated the lake trout and rainbow trout. Information obtained here can be applied to the Great Lakes.

Mr. BOYKIN. Are there any questions, gentlemen?

Mr. HAND. I have several questions, Mr. Chairman.

Mr. BOYKIN. Yes, Mr. Hand.

Mr. HAND. I was interested in your discussion of the lamprey moving from salt water to fresh water. It is an unusual thing to have a species change its habits so completely, is it not?

Dr. MOFFETT. Well, it is quite unusual. We do have a lot of species, however, that do change their habitat for various purposes, such as reproduction and feeding. There are a great many species

that can exist equally well in salt water and brackish water and fresh water, that move back and forth with the tide, and so on.

Then, in the salmon group, which migrate into fresh water to spawn, and when the eggs hatch out and the salmon become of proper size they go down to the ocean, to the outside ocean waters and come back at the end of their cycle to spawn. While it is an unusual circumstance, it does occur.

Mr. HAND. As I understand your previous testimony, the lamprey is causing great damage to fisheries in the Great Lakes; is that right?

Dr. MOFFETT. The Great Lakes have been added to the lamprey's attack.

Mr. HAND. That is perhaps the better way to put it. But he does damage?

Dr. MOFFETT. The record gives evidence, direct, that he does. There is more evidence on the Pacific Coast, however, that the species out there does attack the salmon. It is a rather difficult thing, but in California and Washington State they are interested in it, and they are working on that species of lamprey out there.

Mr. HAND. Do you know how much damage is done to the fisheries?

Dr. MOFFETT. To the California fisheries they say the run of salmon is cut, the run to the hatcheries is less.

Mr. HAND. How about the ocean itself?

Dr. MOFFETT. I do not believe there is any evidence, to my knowledge, of loss that could be developed positively.

Mr. HAND. Did they come up with any specific figures as to the amount of damage?

Dr. MOFFETT. There is damage, but the population involved is so widely dispersed that the measure is difficult to get. Things like that have been so closely associated for so many years that they would be superimposed on the situation. The lamprey have been connected with the fisheries so long, that we go along getting this view, and for that reason we cannot measure, and we do not know what it was like before.

Mr. HAND. The fishing is off, and one of the reasons it is off is directly attributed to the population now of lamprey?

Dr. MOFFETT. We have had that presented to us a great many times in discussions, and the thing we can be absolutely certain of now is that in Lake Michigan and Lake Huron there is not the fishing, the commercial fisheries fishing.

Now there could have been an epidemic, or something of that sort, which would have reduced the lake trout before; I am sure that would have been observed, because we had an epidemic a few years ago that wiped out the smelt, which was highly observed, and in fact, the epidemic was so rapid that you could tell where the smelt were by their odor.

Mr. HAND. Obtaining sufficient quantity to supply the market has been made difficult by lamprey?

Dr. MOFFETT. I believe the commercial fisheries is down—I know, the first studies we have indicate they get as much as 25 percent off in their catch.

Mr. HAND. The whitefish is also a delicacy and commands a high price, does it not?

Dr. MOFFETT. Yes.

Mr. HAND. What other special fish are found in the lake markets?

Dr. MOFFETT. There are a great many species. We have the lake of the chubs, which is a relative whitefish, and a highly desirable fish; with approximately 20,000,000 pounds caught in Michigan.

Then we have the yellow perch and the yellow pike; they are produced in rather large quantities.

Then there is the carp, the bullhead, and the trout (rainbow, brook, and brown).

Mr. HAND. Most of them are in the category of a market delicacy?

Dr. MOFFETT. Not as much as the other fish. They are lower in price. The lake herring is a highly desirable fish, but it sells for something like $60 a ton. It is a desirable fish, but it is taken in such quantities that it is not sold at such high prices.

Mr. HAND. Has the production of these other fish that you have mentioned likewise gone down with the lake trout and whitefish?

Dr. MOFFETT. The whitefish and the lake trout where the damage has been approximately the same.

Mr. HAND. Is there evidence that the lamprey has done a major amount of harm to any other species except the lake trout and the whitefish?

Dr. MOFFETT. Yes; they have worked on the suckers very thoroughly, and they have worked on the perch and lake chubs very thoroughly.

Mr. HAND. Do you have any evidence available as to the relative percentage of fish taken?

Dr. MOFFETT. We did not bring that with us.

Mr. HAND. You do have it?

Dr. MOFFETT. The statistics are available.

Mr. BOYKIN. Would you like to have that furnished?

Mr. HAND. I think it would supplement our record.

Dr. MOFFETT. Very well. I think I have a copy of the 1948 statistics in my brief case.

The need for this increased appropriation arises from the fact that we have only two places where we can depend upon for experiments. There are two items: One is the item for additional structures for a checking device, and the major item in that is the item of $126,000 for construction.

Mr. HAND. I think you mentioned it, but I wonder if you would go over it again, where the lamprey goes to spawn. You were looking up those statistics?

Dr. MOFFETT. Yes. I have this one note here. I can give you the statistics for 1948. And we have gone back as far as 1943. But that material is available, and I will get it for you.

Mr. HAND. I think it would be helpful if it is not too much trouble.

Dr. MOFFETT. Now, if you will refer to this chart we have indicated the area, largely in this section [indicating].

They start out as very small eggs. The average female lays approximately 62,000 eggs. The eggs are disposed of near this spot [indicating]. The two lamprey get together and raise a gravel nest, pile it up something like that [indicating].

Mr. BOYKIN. How do they build the gravel nest?

Dr. MOFFETT. The gravel nest is in this shape [indicating]. They pile the rock up, and the male wraps himself around the female; the eggs are squeezed out, extruded by the female, and fertilized by the male and they are caught in the interstices and are carried by the current

into the gravel of the nests, and, depending upon the temperature, the eggs are hatched in from 7 to 12 days. The larvae that hatch are very tiny, a fourth of an inch. They go down the stream from the rapids where they were born until they reach mud and silt flats, where they sink to the bottom and establish themselves in burrows. The food, which is sucked in from the passing water of the burrow, is largely made up of microscopic organisms that live in the surface film of the stream bottom.

During this stream life the young lamprey are completely harmless. According to the evidence we have the length of the larve life is about 4 years. Then they go through a transformation. They do not look like a lamprey in this stage. They look more like a flat needle, something like this [indicating]. At that stage they have a mouth something like this [indicating]. They have a lot of different characteristics, but they go through this transformation stage and get to the point where they start growing their eyes and begin to take on adult characteristics.

Mr. POTTER. They are like the ones shown in the little bottle you exhibited to us?

Dr. MOFFETT. Yes. This little bottle shows them in the transformation stage, something like the stage the butterfly goes through in coming out with wings. And when they come out they look like this [indicating], with this sucker mouth and with all of the characteristics of the parasite.

After they mature, and go through this transformation stage, they take off downstream toward the Lakes. The transformed larvae range from 3.7 to 7.2 inches long and average about 5.5 inches. The downstream movement usually occurs at the time of the rising water levels. The young lampreys leave the streams in the late fall and some of them migrate at various times during the winter, but the major downstream movement occurs at the time of the break-up in the spring. When these young sea lampreys reach the lake they are ready to begin their parasitic existence.

We have indirect evidence that it takes them about 12 to 17 months, that is, takes the parasite about that long to reach the adult stage. Apparently they go down in relatively deep water after they start out and they are found in June and July attached to lake trout, chubs, and other deep-water species.

They can get to adult size in a matter of 2 or 3 months, depending upon how good their growth may be. As they grow larger they move toward the shore and in the fall are to be found in relatively shallow water. It is at this time that their attack on shallow-water fish, such as white fish and suckers, reaches the maximum.

Then early in the spring, when the stream temperature reaches 40°, when it has a tendency to become warmer than the lake water, they will assemble off the mouth of the stream; they enter the stream and migrate up the stream and carry out their spawning processes again, and when they are spawned they die, and disintegrate rather rapidly.

That brings us to the major point of control: As they are going upstream, and also as they are coming downstream, during their concentration and migration period, they are vulnerable and can be captured or killed in large numbers.

Mr. HAND. You have, I suppose, a list of the streams in which the spawning process can take place?

Dr. MOFFETT. We do not have a complete inventory, but I will give you what we have. Beginning at this point over here [indicating], on around to Sault Ste. Marie, at this point on the lake, there are 112 streams where control might be necessary.

There are seven streams in which adult lamprey were seen and were reported.

Fourteen streams in which nests were observed.

Twenty-three streams from which lamprey were taken; and 45 streams where potential weirs were located for control, so that compares rather favorably, in our favor; some 807 streams examined.

I think that the ratio in the northern part of Michigan [indicating] and on this side of Wisconsin is optimistic. They have a little tougher time in Lake Superior than they do in the lower waters.

Mr. HAND. Do you think your knowledge is sufficient about the characteristics of spawning in streams so you can eliminate certain streams from consideration? In other words it is not correct to say that we have an enormous number of streams with which we have to deal?

Dr. MOFFETT. Yes.

Mr. HAND. You are able to get the number?

Dr. MOFFETT. There is a number of them. We have approximately 120 in the Lower Peninsula of Michigan.

Mr. HAND. What I was trying to get at is whether it is possible to cope with it?

Dr. MOFFETT. It is quite possible; we are very optimistic; we have no doubt about the outcome.

Mr. HAND. Through control of the streams?

Dr. MOFFETT. Yes.

Mr. HAND. I was very much interested in your comments concerning the possible investigation of this anticoagulin that you referred to. That is speculative as yet, and depends upon research, but it would be of enormous value?

Dr. MOFFETT. That is right. But we prefer to see that work done in the medical schools where they have the equipment and the material to carry out the experiments. We are not equipped to do that.

Mr. HAND. Have they shown any interest in doing it?

Dr. MOFFETT. Yes; they have so stated, and are doing it, and we are sending the material to them.

Mr. HAND. Have they developed any plans for doing it?

Dr. MOFFETT. They have asked us when we would be able to give them materials, and we have asked them whether they wanted it frozen or alive or in just what state they would like to have it.

Mr. HAND. You have indicated several methods of control. One is by weirs?

Dr. MOFFETT. Yes.

Mr. HAND. The second is by the application of electricity?

Dr. MOFFETT. Yes.

Mr. HAND. Another possibility would be killing off a sizable take through the catch, as they go upstream for the purpose of spawning, without the attendant kill of other fish.

And a third is by means of bypassing them with other fish.

Is the third method you mentioned in your judgment possible or feasible?

Dr. MOFFETT. We have got to work out a plan that can work without killing the trout. We would run into considerable objection.

Trout in Michigan is an important fish, and it just would not be right if we were to kill off any percentage of trout using the streams. We would experience considerable difficulty in selling that idea.

Mr. HAND. You are talking now about the well-known spots in Mr. Potter's area?

Mr. BOYKIN. I am glad you mentioned that, because I want to ask you a question, because I have been asked the explanation many times, and I would like to get it. Have you ever heard about the jubilee fishing that we have down near Mobile?

Dr. MOFFETT. No; I have not.

Mr. BOYKIN. We have that two or three times a year when the salt water comes in from the Gulf, into Mobile Bay, when there are millions and millions of fish, and people come there and just pick them up by the thousands. I have not seen it, but I know my children have, and I was just wondering if you could tell us what happens. The fresh water and brackish water come together, with the salt water, and I was wondering if you could tell us what causes the run. People come in there and take hundreds of tons of fish.

Mr. HAND. It might be a good thing to go down there at that time.

Mr. BOYKIN. I would be glad to have you do so. It only lasts for about 2 hours, but I would like to have you come down there and wait until it happens. It is a most interesting thing. I am going down there again, and I would like to have someone go down there and see if they can tell us what causes it. Do you have anyone down in that area?

Dr. MOFFETT. We have a group at Galveston, and some of them might be able to answer your question.

Mr. BOYKIN. Are there any further questions, gentlemen?

Mr. ALLEN. Dr. Moffett, I wonder if you could tell me how many people you have working on this project?

Dr. MOFFETT. We have approximately 35.

Mr. ALLEN. And how many would you have with the increased appropriation that you are now requesting?

Dr. MOFFETT. I will have to look that up——

Mr. HAND. That brings up a question that I would like you to look up for me——

Dr. MOFFETT. There will be eight positions which are now authorized in our organization and personnel section; and five additional positions. The highest position is grade GS–7, and the lowest one is GS–3.

Mr. ALLEN. That would be 48?

Dr. MOFFETT. Approximately that; yes.

Mr. ALLEN. Can you tell me whether or not you are getting any assistance in the form of personnel or funds or equipment and materials from any of the States on this work?

Dr. MOFFETT. We are getting assistance from the State of Michigan to the tune of about $10,000 a year. They maintain one experimental dam, for us, and they pay the salary of one man at another station.

The State of Wisconsin is operating three weirs—six weirs this year on their own, and Minnesota has surveyed most of her waters in the northern part of Lake Superior in here [indicating].

I might explain, Mr. Allen, that the State of Wisconsin was going to have a representative here, and he may come in before the hearings

are closed, to explain how they fit in on this arrangement. Maybe I should not attempt to speak for them, but in Michigan, a large portion of the revenue comes from sport fishing and the revenue derived from commercial fisheries of the State is hardly sufficient to pay for patroling.

They feel somewhat at a loss to know—perhaps I should not be speaking for the record, because I do not know about it personally—but the general feeling is that they hesitate to appropriate money acquired from sport fishing licenses, for the Great Lakes themselves—I think perhaps I had rather leave that to the Michigan representative.

Mr. BOYKIN. Any further questions?

Mr. BENNETT. Could you tell us, Dr. Moffett, which aspects would be done by the additional funds that are not being done now by the States working together at the present time?

Dr. MOFFETT. What aspects would be done with the additional funds?

Mr. BENNETT. Yes.

Dr. MOFFETT. I think some of you have had the opportunity to study the proposal, which was prepared covering the construction of certain weirs that we consider necessary as a checking device. One of the proposals was submitted sometime ago, and it involves the construction of seven large-type weirs, costing between $12,000 and $23,000 each.

Mr. BENNETT. That sounds like one-time stuff. You are asking for $500,000 each year?

Dr. MOFFETT. That is one-time stuff. The potential weirs we are talking about here, five or six of them, come to some $126,000 of construction money.

Then the cost of operation and maintenance of these weirs is involved, and also the operation of a research vessel is involved.

The increase requested is the difference between the $216,000 and $500,000. So that these things can be acquired, so that a vessel can be operated in order to gain additional knowledge about what the lampreys do in the Lakes we need to go out into the Lakes. We cannot stand on the shore of the Lakes, and we have not learned how to walk on water, so we need to have some means of getting out from shore, and the operation of a vessel is going to cost some $25,000, approximately, a year.

Mr. ALLEN. You do not have one now?

Dr. MOFFETT. We have one little vessel which was built out of the first year's appropriation.

Mr. BOYKIN. At what cost?

Dr. MOFFETT. Approximately $76,000. The original construction was to be at $64,000, but additions and changes brought the cost up.

Mr. ALLEN. How much of the increase that you are asking for is actually one-time expenditure?

Dr. MOFFETT. The $126,000 is considered as construction.

Now our plans for it involve the construction of warehouses and docks, which is roughly an item of some $100,000 in order to take care of that vessel.

At the present time dockage fees and warehouse space will cost us in the neighborhood of $70 a month for the vessel. And we are in the position of paying some $30 a month for service.

We plan to continue to use somewhere in the neighborhood of $126,000 for the next 3 years. As you know, we occupy the old Coast Guard building, and when I say old, it is old. It was built with hand-hewn timber, and we have got to do something about that building; the foundation is rotting out; we have got to use some money in another year to repair and refurbish the Hammond Bay building.

Mr. ALLEN. Could you tell us approximately, assuming you get the requested appropriation, what the benefits and what proportion between the value of the catch would result?

Dr. MOFFETT. What is it; about two-thirds Michigan and about one-third Wisconsin?

Dr. HILE. Michigan as a trout fishery, would be the principal beneficiary. On Lake Michigan the catch would be about equal. On Lake Huron and Lake Michigan—Michigan accounts for about two-thirds of the production. Minnesota, Wisconsin, and Michigan would be the principal beneficiaries. In determining the beneficiaries, to a considerable degree, it depends upon the value of the trout fisheries. Also, Indiana and Illinois would benefit.

Mr. ALLEN. The benefit that commercial fishery is going to receive from an appropriation in solving this problem would be what?

Dr. MOFFETT. Would you mind If I stepped down and let Dr. Hile take over? He has gone into that matter much more extensively than I have. He has been connected with this matter for something over 20 years.

Mr. HAND. Mr. Chairman, I would like to ask Dr. Moffett if he could have supplied to the committee for the record and also supplied to the individual members of the committee a breakdown of expenditures by the Fish and Wildlife Service on this problem since 1946, and at the same time supply the committee with a fairly complete story of the value of the fish catch in the light of what is involved, if that meets with the approval of the chairman.

Mr. BOYKIN. I think it would be very good to have that in the record.

Mr. HAND. Also the amount the Canadians have spent?

Dr. MOFFETT. What the Canadians have done would be rather hard to get in detail. Although they are very cooperative.

Mr. BOYKIN. Thank you very much, Dr. Moffett.

(The information referred to follows:)

FISCAL YEAR 1950—FUNDS AVAILABLE AND EXPENDED BY GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, DEPARTMENT OF INTERIOR

Money made available by congressional appropriation for the purpose of developing sea-lamprey controls and studying the Great Lakes fisheries late in October 1949 amounted to approximately $259,000. Preparation for the increased responsibility involved selection of personnel, establishment of field stations, procurement of equipment and supplies. Costs of implementing this work and of carrying on that portion of the operations started in fiscal year 1950 are itemized below:

1. Enlarging and reorganizing headquarters at Ann Arbor, Mich.; recruitment of Ann Arbor personnel, purchasing of equipment, automobiles, trucks, supplies and scientific instruments	$36, 686. 34
2. Salaries for Ann Arbor office personnel including biologists, administrative personnel for entire project, and specialists	28, 000. 00

3. Establishment of Hammond Bay field laboratory near Rogers City, Mich., installation and operation of 12 temporary blocking weirs in streams entering Lake Huron; assisting the States in purchase of materials for 8 blocking weirs in Wisconsin streams and 1 in Indiana; experimentation to learn fate of runs of sea lampreys when blocked from spawning grounds; equipment and starting of two survey parties on Lake Superior streams between Keewenaw Peninsula and St. Mary's River	$56, 806. 66
4. Establishment of a field laboratory at Sturgeon Bay, Wis., for the purpose of investigating sea lampreys and fisheries of Lake Michigan waters	8, 670. 00
5. Establishment of a field laboratory at Marquette, Mich., for the purpose of learning the condition of the only remaining stock of lake trout, the life history of lake trout, and the rate of spread of sea lampreys in Lake Superior	13, 651. 98
6. Purchase of a Burkey electric screen for installation in Chocolay River, near Marquette, Mich	6, 161. 00
7. Research vessel construction contract	76, 361. 59
This vessel, a 60-foot, steel-welded hull, was designed and contracts were let in June 1950. Construction started immediately but was slowed considerably by shortages of materials. The vessel will be completed by June 1951. She will implement our work on the life history of sea lampreys in the Great Lakes and provide means for studying the fishery of these large waters.	
Contract for development of electrical devices used in control of sea lampreys	32, 945. 57
The need for electrical engineering talent in furthering our objectives in the field of electrical, electronic, sonic, and other similar energy forms developed very early in our program. It was definitely to the advantage of the Government to contract for such services rather than to attempt training of biologists in this complex field.	
Total expenditures during fiscal year 1950	259, 283. 14

FISCAL YEAR 1951—FUNDS AVAILABLE, EXPENDED AND REMAINING TO BE SPENT BY GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, DEPARTMENT OF INTERIOR

The original budget request for this fiscal year amounted to about $216,000. Cuts and reductions ultimately lowered this amount to approximately $197,570. Our program of investigation on the sea lamprey and its relation to the fishery of the Great Lakes involved the following major categories of expenditures:

1. Headquarters station, Ann Arbor, Mich. The staff was brought to full strength and for the first time salaries were paid for a full fiscal year. It consisted of 5 fishery biologists, 1 statistician, 1 statistical clerk, 1 administrative officer, and 5 clerk-stenographers (and typists). Fellowships, involving part-time employees, were established at University of Wisconsin for the study of sea lamprey sensory responses, University of Michigan for the development of toxicants effective on and specific to sea lamprey larvae, University of Michigan for a study of the physiology of sea lamprey feeding and to develop knowledge of anticoagulant substances produced by lampreys, Cornell University for further investigation into the life history and associates of sea lampreys native to the Finger Lakes of New York State. Statistics of the Lake Trout fishery were analyzed and the results published for Lakes Huron, Michigan, and Superior. Contracts let last fiscal year were administered and brought to conclusion with final reports. Data were assembled on other fisheries of the Great Lakes. The entire investigation was coordinated and directed from this office. Cost, $75,160.

2. Hammond Bay laboratory was brought to full operating strength involving additional personnel and equipment. Surveys of Lake Superior streams were continued and interim reports prepared. Fourteen temporary weirs for sea lamprey control experiments were reinstalled; improved and maintained. A system of cost accounting on weir operation was instituted. Biological studies pertinent to experimentation with electrical, natural, and other control agents were carried on. Studies of the food requirements, diseases, parasites, meta-

morphosis, dispersal, and mortality rates of sea lampreys were begun. Lamprey trapping devices were developed and placed in operation for tests below large dams in two rivers. Engineering estimates and cost analyses were made for several large weirs needed in experimentation with devices applicable to large rivers. Cost, $92,210.

3. Continuation of Sturgeon Bay, Wis., field laboratory. Programs dealing with migratory habits of yellow perch, biology of lake herring, population characteristics of lake chubs, occurrence of sea lampreys in western Lake Michigan were started. A cooperative project on experimental suppression of sea lampreys in Wisconsin waters was undertaken with the State conservation department. Cost, $11,350.

4. Continuation of the Lake Superior field laboratory at Marquette, Mich. An intensive check of catches of lake trout to determine percentage of lamprey scarred individuals was started. Biological data were gathered on the life history of lake trout. Lake trout were tagged to determine their migratory habits and distribution in Lake Superior. This campaign is a continuous project. Complete testing of the Burkey electric fish screen in Chocolay River as a means of selectively blocking sea lampreys while allowing fish to proceed upstream has begun. Characteristics of fisheries for lake herring and whitefish are being observed. Periodic checks are made to learn the extent and rate of dispersal and relative abundance of sea lamprey stocks in Lake Superior waters. Cost, $18,850.

PROJECTED PROGRAM AND BUDGET ESTIMATE FOR FISCAL YEAR 1952—GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, DEPARTMENT OF INTERIOR

The program of investigations and cost of operation were scaled to the presently effective congressional authorization of $216,000. Should an increase in authorization be granted and a supplemental appropriation be made for this fiscal year, the plans for this fiscal year would be altered to conform essentially with the program and budget presented for fiscal year 1953. Otherwise, operations will approximate closely the program of fiscal year 1951, since none of the studies undertaken at the inception of this work will be completed short of an additional season of observation and testing.

There follows a breakdown and brief description of the essential features of our program as based on a budget of $216,000.

1. The headquarters station at Ann Arbor, Mich., will continue the fellowships established, administration of all projects, and analyses of fishery statistics. The staff will implement life history and ecological studies of lake trout, whitefish, lake herring, and other fishes important to both sport and commercial fishing interests. Predation of sea lampreys upon fish species other than lake trout and fresh-water burbot following the disappearance of these preferred food items will be followed closely in cooperation with the Hammond Bay and other field laboratories. Estimated cost (includes part of vessel operation costs), $80,011.

2. The research vessel will be operated during at least part of the open-water season on Lake Michigan to determine distribution and characteristics of sea lampreys and their possible prey species in the lakes. Gear and methods will be developed for taking lampreys from lake waters. The vessel will be employed also to gather important data on water currents, chemical and biological characteristics of the lake as they bear on fish production, water temperatures, and fish food production in the lake bottom and lake waters. The vessel would be staffed by two permanent and two temporary crew members. Biologists from Ann Arbor and Hammond Bay would be detailed aboard as scientific staff. Estimated cost (included in Ann Arbor and Hammond Bay estimates), $21,000.

3. Hammond Bay field laboratory will continue essentially as in last fiscal year. Many of its research projects will be brought to completion and results therefrom will be written up and reported. (Some of the experimental control devices and new approaches to control could demonstrate very positive results at any time prior to the close of fiscal year 1951 or late in fiscal year 1952. Sufficient elasticity is being maintained in the program of this station so that pilot operations could be set up without delay. Several projects would be terminated and all effort placed upon the pilot operations to perfect them with no great loss of time and money.) Field trials of promising toxicants on lamprey larvae will be conducted. The problems surrounding use of American eels as natural enemies of sea-lamprey larvae are scheduled for examination. Developments in the fields of electricity, sonics, and light are to be refined and possible directions explored for application of them as lamprey control agrents. Additional emphasis is to be placed on the use of possible sterility-producing agents such as irradiation with

various light and sound frequencies and exposures to high-frequency electrical shock. Experimentation with methods designed to kill lamprey eggs during incubation is to be added to the research program. No further extention is planned from the experimental control zone operations involving the 14 weirs mentioned in previous programs. These operations will have yielded sufficient information for basic planning of actual control operations with physical barriers should other methods under study fail completely. Depending on the actual amount of funds received, portions of this experimental control zone will be inactivated. Only those structures which will add to our knowledge of the abundance index of sea lampreys will be continued in operation. Surveys of Lake Superior streams as potential or actual spawning grounds for sea lampreys is scheduled to continue. Estimated cost (includes part of vessel operations cost), $103,571.

4. The Sturgeon Bay, Wis., laboratory will operate essentially as in the past. The project involving the migratory habits of yellow perch should be completed if no difficulties hamper operations. Additional efforts will be made to describe environmental influences which produce large year classes of fishes so characteristic of populations in Green Bay and northern Lake Michigan. Estimated cost, $12,234.

5. The Lake Superior Laboratory is scheduled to continue operations without change from last fiscal year. Greater emphasis will be placed upon relationships between sea lampreys and lake trout. Should the sea-lamprey population demonstrate a very rapid increase, as it did in Lake Michigan, this laboratory will direct all efforts toward planning and implementation of a control program with whatever means are available at the time. Estimated cost, $20,184.

PROJECTED PROGRAM AND BUDGET ESTIMATE FOR FISCAL YEAR 1953—GREAT LAKES FISHERY INVESTIGATIONS, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

The program considered essential for fiscal year 1952 and certainly for achievement not later than fiscal year 1953, if material progress is to be made in disposition of the investigative phase of the sea lamprey control problem is outlined herein. As stated in the discussion of the 1952 fiscal year program, the following plans can be actuated whenever funds are made available.

1. Headquarters station at Ann Arbor, Mich., will carry out the program essentially as outlined in plans for fiscal year 1952. To its operation will be added three trained fishery biologists whose responsibility will deal with the problem of establishing indexes of lake trout and whitefish abundance in Lakes Huron and Michigan so a check can be kept on the rate and extent of recovery of these important species as lamprey control is applied. The need for such indexes arises from the fact that commercial fishermen will not begin fishing again until stocks are profitably abundant. There will be no knowledge of recovery progress until the process is well along unless abundance indexes can be established at levels of catch below those profitable to fishermen. These biologists will also be able to keep the fishery of Lake Huron and Lake Erie under surveillance. Added supply and administrative requirements for the entire investigation will increase the headquarters allotment to an estimated total of $103,650.

2. Operations of the research vessel along the lines as outlined in the 1952 program will be carried out. Operation will be guaranteed over an 8-month season and a much needed vessel biologist will be hired. This biologist will make possible uniformity of observations, more effective and economical use of instruments and, above all, he will reduce the need for use of field station personnel aboard the vessel which will otherwise result in serious interruptions of established research programs. Additional items of needed equipment will be acquired for the vessel. Estimated cost of this program segment amounts to $30,500.

3. Hammond Bay laboratory program will not be changed materially as far as scope is concerned. However, it will be provided with facilities covered under item 6 for more rapid and simultaneous testing of experimental sea lamprey control devices. Sufficient materials and personnel will be added to the station to properly operate and maintain the new checking weirs. Estimated costs of operation at this station are $110,575.

4. To the staff of the Sturgeon Bay Laboratory would be added one fishery biologist and one clerk-stenographer. The biologist has been needed since the station was placed in operation. Coverage of the territory involved in the study area has required many additional voluntary hours from the present staff. Another man would ease this situation very much and would lessen the inefficiency resulting from overfatigue. The clerk-stenographer would care for administrative

detail now handled by the biologists. Reports and fishery statistics could be handled effectively. At present, a clerk-stenographer is hired temporarily to transcribe and record catch statistics. The biological program would not be altered essentially over that described for fiscal year 1952. Estimated cost of operations $20,513.

5. The laboratory at Marquette, Mich., will be augmented by the addition of two biologists to the staff. These individuals will make possible an intensified and much needed examination of the life history and ecology of the lake trout. Considerable emphasis has been given to the role of fish hatcheries in rehabilitating the lake-trout stocks. It is essential that we bring to rapid completion the lake-trout study so we will be able to advise intelligently regarding such matters as size of the hatchery product at planting, where and when plantings should be made, life history periods when mortality is greatest, vertical and horizontal distribution of lake trout at various periods in their life and many other problems if the most efficient use of the hatchery product is to be achieved. Raising of lake trout in hatcheries is an expensive procedure. It is absolutely necessary to know the best use of fish produced in these establishments if the cost of production is not to be wasted. Essential segments of the current program at this station will be continued. Cost of operation $41,729.

6. This item involves the major increase in our requirement for funds. It is proposed to construct dependable, semipermanent weirs on several large key streams known to have numerous sea lamprey runs. These weirs will serve two purposes: valuable experimental evidence will be obtained on the operation of structures in large rivers and there will be available dependable checking devices to assess the effectiveness of untried but promising control principles. One of the major handicaps to present tests is the lack of sites equipped with adequate checking facilities. Many devices cannot be tried until space below dependable weirs is available. Under this item, construction is planned for seven permanent-type weirs and five portable-type weirs. In addition to providing adequate testing grounds, these weirs will place effective barriers across every major sea lamprey stream on the Lake Huron shore of the State of Michigan Lower Peninsula. Estimated cost of these installations, $126,000.

Pounds and value of catch, 1935–49

LAKE SUPERIOR

Year	Lake trout		Lake Herring		Whitefish		Total catch [1]	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1935	3,475,900	$489,966	13,115,400	$295,888	512,300	$100,321	17,873,500	$940,608
1936	3,233,200	461,472	11,756,600	336,720	374,100	72,596	16,008,200	928,246
1937	3,084,900	471,575	11,784,100	316,708	363,600	74,447	16,011,300	918,859
1938	3,166,900	452,715	10,593,700	288,334	455,400	90,692	14,856,000	875,013
1939	2,744,200	466,146	13,065,800	313,866	497,000	96,795	16,782,900	921,723
1940	2,676,900	398,226	16,502,100	299,352	692,200	109,145	20,672,400	904,368
1941	2,854,100	474,744	17,837,800	587,285	727,500	152,260	22,111,300	1,309,716
1942	2,959,000	642,775	14,844,200	550,837	751,000	200,462	19,227,700	1,498,338
1943	3,053,400	980,558	13,874,100	854,487	731,700	263,108	18,371,600	2,214,765
1944	3,739,500	1,228,542	14,227,400	670,458	663,300	256,842	19,244,700	2,246,376
1945	3,368,800	1,391,338	14,044,900	775,702	717,300	319,208	18,724,700	2,574,084
1946	3,444,100	1,325,977	13,141,900	525,719	914,900	334,561	17,848,300	2,218,906
1947	2,963,800	883,973	10,808,000	541,616	950,800	213,918	14,987,200	1,673,648
1948	2,953,700	1,206,981	14,705,200	696,279	1,200,600	386,457	19,221,400	2,347,299
1949	2,965,800	1,203,471	13,204,100	437,131	1,283,700	511,418	17,730,300	2,190,111

Pounds and value of catch, 1935–49—Continued

LAKE MICHIGAN

Year	Lake trout		Lake herring		Whitefish		Chubs	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1935	4,872,700	$684,027	5,425,300	$121,628	1,697,100	$323,560	5,794,500	$503,342
1936	4,762,600	735,355	4,796,000	120,739	1,025,500	187,807	5,674,100	690,423
1937	4,987,300	846,311	5,499,500	164,988	1,072,600	224,824	5,579,200	836,869
1938	4,905,600	850,181	4,477,300	180,961	1,258,900	252,616	5,404,100	653,141
1939	5,659,700	1,141,940	2,908,900	119,535	950,600	190,120	4,025,100	644,016
1940	6,265,700	1,063,471	2,675,200	87,823	954,800	173,828	1,647,500	259,653
1941	6,784,400	1,177,074	1,703,200	67,251	1,290,100	270,888	1,629,700	279,327
1942	6,484,400	1,603,285	1,425,900	72,166	1,340,600	405,930	1,755,400	357,863
1943	6,860,300	2,311,425	1,952,200	189,700	1,407,100	506,559	2,214,000	524,261
1944	6,497,500	2,436,363	1,392,900	129,987	1,753,200	646,817	2,607,200	480,647
1945	5,437,300	2,574,626	4,029,700	462,771	1,657,900	814,144	4,221,000	989,387
1946	3,973,800	1,646,434	5,549,900	297,464	2,557,600	867,285	4,524,500	518,826
1947	2,425,400	822,153	5,833,700	356,710	5,824,800	1,295,833	5,086,900	735,631
1948	1,196,700	544,542	8,029,000	390,962	5,247,200	1,687,401	5,929,000	1,175,676
1949	342,100	150,808	6,778,300	264,491	3,491,900	1,304,104	7,421,200	1,233,583

Year	Yellow perch		Suckers		Total catch [1]	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	1,740,200	$113,877	2,550,600	$95,809	25,089,200	$1,942,645
1936	2,507,800	173,123	2,685,900	75,405	25,783,100	2,130,821
1937	2,489,300	248,931	2,381,400	71,446	26,398,100	2,572,761
1938	2,203,600	143,761	1,858,100	55,633	24,379,300	2,293,985
1939	3,089,900	248,910	1,853,100	55,594	23,026,700	2,570,235
1940	2,575,500	211,576	2,016,700	60,622	22,813,700	2,049,510
1941	2,415,500	235,914	1,934,700	75,847	22,918,000	2,374,323
1942	2,647,600	356,279	2,250,800	123,683	21,403,800	3,203,770
1943	3,134,500	475,530	2,200,200	167,879	22,174,500	4,597,706
1944	2,871,600	349,139	2,223,200	131,174	19,252,200	4,341,896
1945	1,468,500	279,117	2,373,100	162,576	22,089,700	5,570,886
1946	1,472,900	229,869	1,895,100	108,067	22,391,700	3,907,364
1947	1,399,400	221,892	1,620,700	101,998	24,957,500	3,875,754
1948	1,513,300	254,427	1,805,500	102,637	27,022,800	4,596,362
1949	1,377,500	218,375	1,810,300	82,225	25,573,200	3,822,719

LAKE HURON

Year	Lake trout		Lake herring		Whitefish	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	1,743,300	$261,495	3,886,200	$116,587	1,894,800	$378,962
1936	1,399,900	195,987	3,982,200	99,554	1,442,200	259,589
1937	1,340,200	201,015	4,150,000	124,498	1,018,700	213,923
1938	1,270,100	190,515	5,428,800	164,450	558,000	111,600
1939	1,371,700	274,340	6,948,000	208,440	255,200	51,040
1940	902,300	144,366	3,302,700	99,081	188,100	33,858
1941	892,100	151,653	3,159,000	118,462	113,700	23,883
1942	727,800	178,384	2,408,200	165,925	95,100	25,240
1943	459,000	151,470	2,009,200	110,506	149,200	53,712
1944	363,400	125,717	1,073,200	94,481	185,200	71,689
1945	172,900	89,334	1,373,000	176,348	181,500	98,259
1946	38,100	15,777	1,461,900	74,703	545,000	213,585
1947	12,300	4,290	1,070,500	70,198	3,022,900	720,771
1948	4,000	1,695	1,636,400	89,034	2,971,900	882,608
1949	900	392	1,951,900	86,520	530,200	217,085

See footnote at end of table, p. 30.

Pounds and value of catch, 1935–49—Continued

LAKE HURON—Continued

Year	Chubs		Walleyes		Yellow perch	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	386,900	$27,080	1,574,000	$236,106	982,900	$78,632
1936	335,100	43,551	1,565,200	219,132	1,175,300	94,022
1937	190,300	28,545	1,626,700	227,737	547,600	54,764
1938	192,100	23,052	1,356,100	135,610	500,400	40,032
1939	173,800	27,808	1,641,300	164,130	565,200	45,216
1940	148,200	23,712	1,572,800	235,920	527,800	47,502
1941	126,300	18,939	1,532,400	229,856	416,300	41,628
1942	80,200	17,644	2,103,900	431,300	574,600	73,032
1943	128,000	33,283	1,659,700	348,537	974,500	146,176
1944	221,200	42,980	1,138,400	197,938	603,500	89,872
1945	190,000	50,996	678,000	203,113	407,200	85,923
1946	39,800	4,438	974,100	247,908	340,500	65,376
1947	126,200	21,972	484,700	108,699	290,700	50,628
1948	158,800	40,402	224,800	59,018	693,900	96,482
1949	147,900	34,219	200,000	52,360	517,600	70,620

Year	Suckers		Carp		Total catch [1]	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	1,761,100	$70,445	1,079,300	$32,379	13,676,300	$1,224,062
1936	1,813,700	47,466	770,000	23,101	12,790,100	999,769
1937	1,725,900	51,777	978,100	29,341	11,895,000	951,116
1938	1,788,200	53,646	631,100	19,033	12,038,700	759,830
1939	1,381,700	41,451	739,300	22,279	13,352,700	866,047
1940	1,343,800	40,314	765,300	22,959	9,098,600	679,909
1941	1,312,300	39,368	668,600	20,058	8,727,000	681,052
1942	1,196,200	46,879	753,400	22,602	8,464,700	1,011,454
1943	1,413,600	79,692	1,242,800	49,712	8,609,700	1,075,262
1944	1,235,600	74,207	1,150,700	53,206	6,432,500	831,690
1945	1,554,100	139,620	2,369,600	157,389	7,474,800	1,129,007
1946	1,646,000	79,995	1,668,600	57,066	7,147,200	842,167
1947	1,282,500	68,066	1,326,500	41,800	8,034,300	1,153,166
1948	1,304,600	73,953	1,458,900	53,483	8,836,200	1,361,625
1949	1,022,300	54,142	952,400	29,348	5,580,500	594,862

LAKE ERIE

Year	Whitefish		Walleyes		Yellow Perch		Blue Pike	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1935	994,900	$154,543	1,783,700	$185,056	9,044,900	$536,716	9,686,100	$479,871
1936	1,158,400	231,410	2,646,900	243,699	2,050,500	139,944	19,908,600	1,194,626
1937	647,500	137,365	3,060,000	254,729	1,750,200	111,314	10,960,800	641,581
1938	910,900	186,735	3,134,600	313,460	5,186,900	410,458	8,659,400	590,148
1939	2,098,100	354,723	4,767,400	386,703	1,607,800	156,379	9,049,300	696,327
1940	2,605,800	395,017	3,869,600	437,802	3,031,000	267,005	4,950,800	392,939
1941	2,445,900	437,114	2,909,800	366,367	3,821,000	362,288	3,286,700	339,485
1942	1,923,900	430,751	2,971,600	538,044	1,958,500	293,814	6,221,700	786,427
1943	949,000	313,795	3,222,100	729,892	1,252,900	296,981	11,227,600	1,758,872
1944	567,400	214,946	3,498,200	761,266	2,188,000	302,082	14,933,100	1,558,181
1945	900,000	355,872	5,319,100	1,277,986	1,352,200	231,107	7,772,400	1,194,600
1946	797,000	295,812	6,219,300	1,343,759	2,684,700	509,452	3,012,300	715,356
1947	1,773,800	570,313	3,914,100	1,046,992	1,797,200	399,119	3,119,500	729,302
1948	2,789,400	818,067	4,021,300	1,002,438	2,639,500	394,230	9,002,600	1,193,952
1949	3,478,649	993,548	5,313,848	1,086,843	2,659,098	380,861	13,999,491	1,551,634

See footnote at end of table, p. 30.

Pounds and value of catch, 1935–49—Continued

LAKE ERIE—Continued

Year	Sauger		Sheepshead		Carp	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	1,537,400	$77,447	2,351,100	$53,117	1,949,800	$45,708
1936	1,737,500	104,579	3,509,700	70,951	2,687,000	60,532
1937	1,214,300	70,508	4,059,200	65,197	2,153,100	45,290
1938	844,400	84,434	3,392,300	100,235	2,209,500	67,397
1939	1,740,300	174,030	3,493,800	102,709	2,445,000	79,228
1940	613,700	55,607	2,960,400	60,444	2,485,800	54,326
1941	772,600	72,216	3,645,600	90,437	2,554,700	67,143
1942	1,345,700	170,427	4,547,000	216,871	2,447,700	90,539
1943	1,045,600	180,022	4,512,800	327,788	2,231,700	165,674
1944	615,800	73,778	2,451,500	118,379	1,931,500	71,797
1945	1,043,300	187,601	4,405,000	179,158	2,153,100	67,263
1946	762,200	121,827	4,264,500	233,406	1,880,500	128,025
1947	387,900	94,182	3,230,300	170,651	1,755,200	114,068
1948	250,200	43,126	3,675,800	182,908	1,595,900	90,520
1949	390,100	50,251	3,084,700	123,597	2,234,009	67,929

Year	White bass		Sucker		Total catch [1]	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	739,300	$43,513	1,085,900	$23,947	30,356,500	$1,643,632
1936	663,900	33,050	946,100	19,473	36,777,100	2,154,403
1937	435,100	19,846	1,103,300	20,069	26,932,600	1,435,648
1938	727,300	42,926	756,000	29,275	27,619,100	1,981,202
1939	711,600	40,398	1,008,300	38,990	28,663,400	2,216,274
1940	469,400	27,535	713,800	14,545	22,944,000	1,771,996
1941	459,300	36,086	698,100	18,411	22,063,000	1,882,508
1942	516,400	53,034	698,400	36,293	24,131,000	2,740,572
1943	459,600	79,573	575,600	48,605	27,114,600	4,134,349
1944	860,200	67,482	455,800	24,271	28,836,700	3,319,984
1945	883,400	158,156	426,200	21,503	28,630,900	4,266,919
1946	821,300	149,125	431,700	30,317	29,120,700	4,489,250
1947	497,300	103,740	568,300	43,134	19,818,300	3,812,659
1948	498,400	85,735	468,800	22,929	26,501,600	4,101,873
1949	807,187	101,480	63,113	13,105	34,249,333	4,618,089

LAKE ONTARIO

Year	Lake trout		Whitefish		Ciscoes		Blue pike	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1935	6,800	$723	40,500	$4,789			135,700	$10,812
1936	8,200	1,155	53,100	7,962			27,900	2,507
1937	12,900	1,532	56,700	8,880			60,100	4,610
1938	16,900	3,440	55,800	11,160	36,100	$4,332	58,500	4,095
1939	16,400	3,280	103,700	20,740	68,800	10,320	102,100	10,219
1940	13,700	1,781	111,100	16,665	94,700	10,417	122,600	11,034
1941	3,000	441	60,000	10,261	72,100	12,098	97,600	10,451
1942	1,400	338	21,000	4,872	74,100	15,806	39,600	4,890
1943	3,400	909	26,000	8,246			45,100	7,296
1944	3,500	1,217	57,400	17,485			56,200	7,294
1945	500	202	32,700	12,208			77,080	9,820
1946	1,400	575	44,100	14,976			128,200	20,192
1947	700	220	21,300	4,993			208,500	40,887
1948	300	99	8,200	2,186	49,800	10,282	118,900	24,165
1949	17	5	2,426	1,133	45,943	8,351	85,754	16,351

See footnotes at end of table, p. 30.

Pounds and value of catch, 1935–49—Continued

LAKE ONTARIO—Continued

Year	Walleyes		Carp		Total catch [1]	
	Pounds	Value	Pounds	Value	Pounds	Value
1935	18,300	$2,000	24,000	$521	770,000	$54,332
1936	9,100	1,187	12,900	365	601,000	45,767
1937	3,900	559	86,200	3,376	618,400	52,396
1938	2,200	220	134,700	8,082	689,500	54,406
1939	6,200	744	917,200	36,688	1,456,100	107,554
1940	5,600	840	763,700	30,548	1,359,000	92,479
1941	3,000	495	93,800	4,409	597,400	59,441
1942	2,300	441	51,700	1,706	325,300	39,271
1943	2,700	614	65,000	5,468	395,300	59,570
1944	4,100	920	15,900	680	400,000	67,595
1945	2,500	598	104,600	5,789	491,900	73,580
1946	4,200	919	15,800	1,061	383,700	67,598
1947	3,600	872	16,200	794	463,600	81,064
1948	2,300	653	20,800	583	385,500	64,908
1949	1,872	462	20,593	414	351,043	53,268

[1] Includes miscellaneous species not listed in body of table.

STATEMENT OF DR. RALPH HILE, FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. POTTER. I do not know whether you want me to call Mr. Cooper, of Ann Arbor, Mich., or whether you would prefer to have a statement made by Dr. Hile first?

Dr. COOPER. I just walked in, and I do not know what has been covered.

Mr. POTTER. Would you prefer to have Dr. Hile proceed first then?

Dr. COOPER. I had just as soon wait.

Mr. BOYKIN. We will be very glad to hear you, Dr. Hile.

Dr. HILE. Thank you. My name is Ralph Hile; my home is Ann Arbor. I am associated with the Fish and Wildlife Service, as a research biologist on the Great Lakes, and I have been at Ann Arbor for something like 20 years, and on the Great Lakes something over 17 of those years.

I should like to tell the members briefly, particularly those who are not from the Great Lakes area, something about the background of the problem. I judge from certain inquiries that were propounded to Dr. Moffett, that there are members and others interested in fisheries, who are interested in this matter, and I would like to take just a moment to tell you something about the value of fisheries.

The commercial fisheries of the Great Lakes and in the United States waters approximates 75,000,000 pounds of fish per year. That in itself is not a particularly impressive figure, but the impressive thing about these fisheries is the value of the take, which is out of all proportion to the mere poundage. They are the principal and only domestic source of some of the most highly prized delicacies to be had. The lake trout, the whitefish, the lake chubs, and I could mention many more, something like 15 species all told, have considerable commercial value. These fish, as I say, are highly prized for their fine delicacy. I believe it was mentioned that the lake trout on the market run at something like 70 cents a pound, and fishermen have reported to us the whitefish market as high as $1 a pound, so that the average price is a great deal more than you see for many

other fish, and the actual value is much greater than one would suspect.

I would like to give you some fishery statistics, and you will pardon me if I use 1943 and 1944 statistics on which these figures are based. I did that deliberately and I would like to have you note that was before the loss of the lake trout.

We have heard a great deal about the salmon fisheries in the Pacific coast area. The production has been as much as a billion pounds a year, which must be 13 or 14 times the poundage of the catch in the Great Lakes, yet in the same year, the dollar value of the Great Lakes fish is almost equal the dollar value of the Pacific salmon catch.

Another comparison might be made concerning the dollar value of the Great Lakes fish, that in 2 years it amounted to approximately 60 percent of the dollar value of the fishermen in the salmon industry in Alaska and in the United States combined. The dollar value to the fishermen in the Great Lakes that year amounted to about 55 percent of the combined value of the catch at Portland, Boston, and Gloucester which are three of the largest ports that we have. That indicates that fishing has a tremendous value to the fishermen and the loss of the lake trout has created an enormous economic gap to the communities along the Great Lakes.

The commercial fishery is only a part of the story. The Great Lakes are a rather unique area, geographically. The Lakes contain many fish of great interest to sportsmen, and it constitutes, without question, one of the greatest fishing areas to be found anywhere. About 10 per cent of the entire population of the United States lives in the counties bordering on the Great Lakes and about 40 percent in States bordering on the Great Lakes, so you have a tremendous lot of people who can do fishing and who do fishing.

Those of you who have seen vessels docked along the piers along the Lakes and those of you who have heard about the smelt runs will realize how many people do participate in fishing.

The State of Wisconsin, for example, conducted a survey, and on the basis of that survey came up with an estimate of the number of people engaged in fishing, at 3,000,000 man-days per year engaged in sport fishing—of course, we do not have anything definite; it is difficult to get figures of that sort, but we know it is considerable.

The State of Michigan estimates that at the height of the smelt population, when thousands of people participated in the smelt runs, there were picked up 5 million pounds of fish.

And the catch of white fish, rock bass, and other commercial fish in the State of Michigan is estimated at a catch in the Lakes area, at hundreds of thousands of pounds per year.

Then, we have of course the production which is relatively an unimportant aspect of the sport fisheries, which has a recreational value, and yet that is estimated at some 3 million man-days per year, and the total amount of fish taken must be rather prodigious. Some of them fish entirely for bass, and if you are interested in good bass fishing it is to be found in the western lake area, Pioneer Island, Saginaw Bay in this area [indicating].

Commercial fisheries are in this area [indicating], and some of the waters are reserved entirely for sport fishing. That has an enormous economic value in respect to fisheries equipment, in the amount of

money spent by fishermen for transportation, tourists equipment, fish bait, and the necessary liquid supplies represent quite a bit of money, and it is anticipated that the economic value of sport fishing must balance fairly closely to commercial fisheries.

From the standpoint of the investigations on the lake I think that some of the geographical size of the area might prove of interest. These lakes are not small. Our headquarters have been at Ann Arbor, a short distance outside Detroit. It was recommended as being a central location.

To get an idea of the distance to be covered, it is about 1,000 miles around the lake from this point to here [indicating], and if you go east to the Canadian border you have another 500 miles, which gives you all told something like 1,600, which is about the distance from Vancouver to San Diego, or about the distance from Washington to San Antonio, Tex. So, we do have an enormous district to cover, and that is complicated further by the fact that we have five lakes, and not only does each lake offer some peculiar condition, but different portions of the same lake offer different conditions. And not only do we have these great distances, but we have some 15 people to cover it, so you can see that we have a rather difficult problem of coverage.

The Great Lakes facilities are scattered, with a small staff of observers concentrated in four central points, covering practically all of this area of land and lakes. These fisheries are scattered all around. There is some 5,000 miles of shore line. Michigan has more shore line than any other State in the Union, and I think Congressman Potter's district perhaps has more than any other district.

We have not only to cover the lake area but we have the problem of having a staff; sometimes the number is as few as three men. At the same time we have got to get together a large amount of information. We have to develop statistics, and we have developed a method that has given us about as good material for trout fishing as is to be had on any fisheries, a system that has now been adopted and is used by all the eight States, including the Province of Ontario. We are now undertaking a tabular analysis of the statistics for all the States except Minnesota, Wisconsin, and Ohio. But what we need, and lack, is a systematic coverage. We do have the valuable information covering the Great Lakes but we have not had the facilities for putting the information together. We must understand the job, if we are going to get anywhere, we must have a method that is understandable, and we cannot have that without proper research facilities, and today we lack such facilities.

Within the past 2 years we have concentrated on the record of the lamprey attack on trout.

We have neglected almost entirely some islands, but we cannot neglect any of these areas if the situation is to be remedied, if the fish that are subject to be attacked by lamprey are to be saved.

Out at Green Bay we have included a division, a rather small joint operation, where they are contributing about 60 percent of the total production of the Lakes, and there is a staff out at one of the places, and they are putting tremendous pressure on the fisheries to supply information, particularly at the season of the year when fishing is in a healthy condition and when the number of fish taken is abnormally high. We are gathering that information, and we want to

have some information concerning the types of fish that are hit, if I can use the word.

Mr. BENNETT. Is it not true, Dr. Hile, that there have been few investigations of any magnitude of the Great Lakes fishing problem?

Dr. HILE. That is correct. In the past, and I do not have the exact record, but in the past, the Federal support has been in the nature of a few staff salaries, but most of the work that we have done on any scale has been supported by States who contributed money and effort by trying to get their governments and certain commercial fisheries to operate gears.

As research men we have been optimistic; when we had outside support we collected materials and data as fast as we could. We have, I say, some conclusions based on information we have secured, but we do have to continue to sustain the fisheries if they are to be understood.

Mr. BENNETT. Does anyone wish to question Dr. Hile?

Mr. ALLEN. Dr. Hile, can you tell us a bit about the contributions of the various States for the protection of these fisheries and the relative benefits which the various States obtain from the fisheries?

Dr. HILE. Do you refer to my remarks concerning the past history of our investigations, or do you have reference to the present situation?

Mr. ALLEN. To enlarge on the question a little—as I see it, we are faced with determining to some extent whether the fishery is valuable, and you have given information on that. We are also supposed to determine how much money we can afford to spend on it. Then there is a third question, whether the money should come from the country at large or the region affected, or should there be some other consideration, having in mind who gets the benefit?

Dr. HILE. I think Dr. Moffett told you the approximate amounts being contributed by the States, and the $10,000 by Michigan. It is a little bit more difficult to measure Wisconsin because they carry on their own work. I do not want to be in the position of speaking for the State, but I have this feeling—the States could participate more effectively in the sea-lamprey program if we could tell them exactly what to do. In other words, we cannot tell them just how to control the sea lamprey. We are making a request for funds to obtain information on more efficient methods of control of the sea lamprey.

Mr. POTTER. You feel that once you have concrete recommendations as to control methods, then the States would be in a better position to help?

Dr. HILE. Right.

Mr. ALLEN. How could I go home and answer the question that the taxpayer of California put up a fourteenth of this investigation?

Dr. HILE. Most of the industry on the Lakes, the industry itself, would be in a relatively poor position to contribute anything. They are having a terrible time making a living throughout much of the area where the fishery is approaching a state of collapse.

Mr. ALLEN. You see the type of justification we have to get in this record, or would like to get in the record.

Dr. HILE. The States do have a vested interest in the fisheries. The fish are their property.

Mr. HAND. I suppose in this connection they are not taking the position expressed in the doctrine of United States versus California—they claim the waters in this instance?

Dr. HILE. The States actually own the waters.

Mr. ALLEN. That is what we thought.

Dr. HILE. I do not believe it is a question on the Great Lakes. The State boundaries in the middle of the lake are clearly and closely defined and jealously guarded.

Mr. POTTER. I would like now to call as a witness Mr. Claude VerDuin.

STATEMENT OF CLAUDE VerDUIN, SECRETARY, MICHIGAN FISH PRODUCERS

Mr. VERDUIN. Mr. Chairman and gentlemen, it puts me at a little disadvantage to come to a hearing that has been going on for some time, not knowing what has been said, but speaking for the industry, I would like to point out that we find ourselves in pretty desperate straits. The disappearance of lake trout has been a serious blow to the industry because from the very beginning of the operation it has been one of the outstanding varieties of fish we produce. In the State of Michigan it constituted about 25 percent of our production, and brought in approximately 50 percent of our revenue because it always was a good marketable fish.

You can appreciate what a position any business is in when 50 percent of the revenue is taken away from it. We find that we have been able to make up some of this loss by turning our attention to other species of fish that were not exploited at the time trout were plentiful.

Dr. Hile mentioned the damage of the sea lamprey is not alone the concern of the disappearance of the lake trout, but also affects the remaining fish in the lake because of this shift in fish intensity.

We believe it is going to be a matter of a relatively few years before our chub fisheries are going to begin to decline because most of the people who were engaged in trout production have shifted over and are now fishing for chubs, and the production has increased tremendously and probably far beyond the point where it can maintain itself.

We in the industry are very well satisfied with the work that the Fish and Wildlife Service have done. We feel that they have been doing a very efficient job and have already done a lot of work for the money that has been expended.

I might say that 10 years ago it might have been difficult for a representative of the industry to say that.

We feel that we have much finer cooperation between the industry and the Fish and Wildlife people, and we believe that the States are beginning to become aware of this problem more and more and that we are rapidly approaching the time when they too will take a much larger part in this work.

I realize that is a rather general statement, but that pretty well sums it up so far as the industry is concerned.

I shall be glad to answer any questions that you gentlemen might have.

Mr. HAND. Can you give us some figures on the chub fishing industry for the last 2 or 3 years, the relative amount of the catch and the relative value of the catch, and the average price per pound wholesale?

Mr. VERDUIN. I think one of the other boys would have definite figures to show the increase. We know that it has been tremendous because fishermen who were never interested in fishing for chubs have had to go in that fishery in order to stay in business.

Mr. HAND. What do they sell for wholesale, on the average, and what have they sold for for the last 2 or 3 years?

Mr. VERDUIN. They start out in the spring and usually bring in a price of about 30 cents, and that price will hold pretty well, and then will begin to drop along the middle of May as the weather gets warmer. We strike a bad market situation during the months of July and August when it is almost impossible to ship smoked fish to the eastern markets because they mold. For a while we have a rather demoralized market. Then, with the cooler weather again in September, the market again becomes stabilized and the prices will go back up to 22, 23, and 25 cents a pound.

Mr. HAND. How about the number of fishermen engaged in fishing generally in the State areas you represent as compared to 3 or 4 years ago? Is it relatively stable?

Mr. VERDUIN. Yes.

Mr. HAND. They are fishing chubs instead of lake trout?

Mr. VERDUIN. That is right. They have gone into the cheaper varieties of fish, rough fish, that in previous years were not taken—carp, suckers, sheepshead, and herring.

Mr. HAND. What do the cheap varieties retail for? I am interested in the price per pound because I am interested in having some of my New Jersey fishermen go to the Lakes. I think that they could make more money.

Mr. VERDUIN. The sheephead, the carp, and the suckers are relatively cheap fish and often sell for 3 cents a pound and seldom go beyond 9 and 10 cents, except for a short time during certain Jewish holidays, when there is a demand for them.

Mr. HAND. Is the chub the most important fish now?

Mr. VERDUIN. As far as Lake Michigan is concerned, the southern end of Lake Michigan is practically being supported by the chub fishery with some help from the whitefish fishery. This year there seems to be quite a large amount of whitefish in certain areas in southern Lake Michigan, which is a big help to the fishermen.

Mr. HAND. What efforts have been made by you or your association to obtain help from your State legislatures, and what efforts, if any, are now being conducted by the States involved?

Mr. VERDUIN. I think that that was brought out by Dr. Hile, that the States have contributed to the inquiry work.

Mr. HAND. All I have so far in my mind is that the State of Michigan last year contributed about $10,000.

Mr. VERDUIN. That is right.

Mr. HAND. And it was difficult to tell what the other States contributed in cash because they carry on their own research to some extent.

Mr. VERDUIN. That is right.

Mr. HAND. I have the impression that the State of Ohio has done nothing.

Mr. VERDUIN. The State of Ohio is not concerned about the lamprey situation because Lake Erie is relatively free of them. It

has not been a problem there. The problem has been with the State of Michigan, the Province of Ontario on Lake Huron, and the four States bordering on Lake Michigan, and now with the spread of the sea lamprey up through the St. Marys Rivers into Whitefish Bay, and Lake Superior, it is becoming the concern there of Wisconsin and further west even of the State of Minnesota.

Mr. HAND. What efforts, if any, have you made to form a regional compact or group analogous to the North Atlantic fishing group and the far west and Pacific coast group and the Gulf group?

Mr. VERDUIN. There has been no effort as far as actually working under a compact is concerned. We in the industry believe there has to be much better coordination of activities between the States and just recently we have undertaken to organize a federation of fresh water fisheries that will bring together the existing associations in the 11 Midwestern States. Our main purpose in doing so is to put industry in a position to cooperate on projects of this type. We believe that lamprey control, the establishment of additional hatcheries for the artificial propagation and restocking of some of these depleted areas, the problem of pollution which has become very serious in some sections, and the problem of marketing are all of interest to fishermen operating on the fresh waters, regardless of what State they are in. We are trying to bring them all together.

Mr. HAND. Are your associations composed largely of commercial fishing companies, or individual commercial fishermen, and if so, what is the approximate size of the associations—how many members do they have?

Mr. VERDUIN. Lake Erie is about the only lake that has what you might call large fishing companies. On the other lakes it is almost entirely a proposition of the operation of individuals, of a man owning probably one boat, in most cases.

Mr. HAND. They fish on shares?

Mr. VERDUIN. Yes. It is very largely confined to family operations. You will often find a father and several sons engaged in the business. In the State of Michigan at the present time there are probably 1,300 licensed commercial fishermen, or perhaps half of these part-time fishermen, men who will take out a license and fish through the ice in the winter months and probably do farming for the balance of the year. Out of the remainder of the licensed fishermen, a good 50 percent would be the more substantial operators, those who have a sizable investment in it. The others would be fishermen who probably have $3,000 or $4,000 invested and operate on a rather small scale.

Mr. HAND. I suppose that you would not have approximate figures to indicate the income from commercial fishing in the area?

Mr. VERDUIN. No, I would not. Last year the Michigan fishermen produced 26 million pounds of fish and I believe the conservation department estimated that they had a value to the fishermen at the dock of about $4,000,000 to $4,250,000.

Mr. HAND. If we divide the number of fishermen into that we would get somewhere near the per capita income.

Mr. VERDUIN. Yes.

Mr. ALLEN. Do you have any joint projects that the States are carrying on, between two or more States, in investigations of this type?

Mr. VERDUIN. Yes. I think that you could call the entire sea-lamprey program a joint investigation because the States and the Province of Ontario have organized a sea lamprey committee to meet regularly, and there is a very free exchange of information; in fact, certain phases of the program are actually assigned to certain States to carry out.

Mr. ALLEN. Is that an official group designated by officials from each State and the Province, to get together?

Mr. VERDUIN. Yes; I think those are representatives of the conservation departments of the different States, working with the Fish and Wildlife Service.

Mr. ALLEN. How do you go about coordinating the efforts of these States?

Mr. VERDUIN. I think in this particular case Dr. Moffett could tell you about it. I think that Dr. Moffett is the chairman of the group.

Mr. ALLEN. Take any case other than the sea lamprey.

Mr. VERDUIN. Up to this time, about the only other effort that was made was to bring about uniform regulations, and there it is done just by conferences, people trying to arrive at a program where one will give a little here and another give a little there to bring the regulations into uniformity.

Mr. ALLEN. Who has carried the burden of initiating the conferences?

Mr. VERDUIN. The conservation departments mostly.

Mr. ALLEN. Of one State or two States?

Mr. VERDUIN. Usually two States that have a common problem that gets to a point where it is a little troublesome, where there is a little trouble on some boundary waters, or something like that, and they try to get together and iron it out.

Mr. HAND. Do you have in effect now some uniform regulations that have been adopted by more than one State?

Mr. VERDUIN. Yes.

Mr. HAND. Do you have any information as to the relative value of this type of fishing to Ontario as compared to Michigan, or the other States affected?

Mr. VERDUIN. No; I do not have any figures for Ontario.

Mr. HAND. The fishing interests in Ontario are not large?

Mr. VERDUIN. Yes; there are very substantial fisheries there.

Mr. POTTER. I think it might be well for the committee to know that the Fish Producers Association, of which Mr. VerDuin is the motivating force, has been in constant contact with the Michigan State Legislature, and I think the same is true of Wisconsin. they are more conscious now of this problem, and I think they now wish to find out how they should go into it. We must remember this is the research phase of it, and on the control phase the States will certainly have to come in and carry a portion of the burden.

Mr. BOYKIN. I think that the States should, if we are going to double the amount that we are giving, because it means so much to them.

We thank you very much.

We will now hear from the next witness, Dr. G. P. Cooper.

STATEMENT OF DR. G. P. COOPER, ASSISTANT DIRECTOR OF THE INSTITUTE FOR FISHERIES RESEARCH, MICHIGAN DEPARTMENT OF CONSERVATION

Dr. COOPER. I am here as a result of an invitation from Congressman Potter to attend.

Mr. BOYKIN. I hope that everybody appreciates the work that Charley Potter has done. He has brought the subject up before this committee not only this session but last session. He used to belong to this committee.

Mr. HAND. I never heard of a sea lamprey until Congressman Potter arrived in Washington, and I have never heard of anything else since.

Mr. BOYKIN. He has done a fine job, and we are going to help him all we can.

Dr. COOPER. Michigan has a tremendous interest in the Great Lakes and the commercial fisheries that have been discussed here already. There is no point in my dwelling on that.

We also have a tremendous interest in sports fishing in the Great Lakes, and we are interested in the sea-lamprey problem. As a matter of fact, I think it is correct to say that Michigan sort of took the lead in research on the sea-lamprey work done by Dr. Applegate, who is here. We are also very much concerned over the possibility of the sea lamprey spreading into some of the larger inland waters of the State and thereby becoming a very important liability to the inland sports fisheries.

You have no doubt raised the question since I have been here, and no doubt raised it several times before, why the States are not doing more than they are. You mentioned the $10,000 contribution made by Michigan in the form of research and some control work on lampreys in a portion of the Great Lakes short lines, the northern part of Lake Michigan.

The work that we are doing, small though it is, is coordinated, of course, with the work done by the Fish and Wildlife Service. In addition, the State is probably contributing perhaps an equal amount in the form of intangible cooperation, assistance given by conservation officers, some of the State field officers, and so on, but we realize Michigan's contribution at the present time is relatively small compared to what the Government is putting into it.

There are a few important reasons behind that that I think might be mentioned here. As Dr. Hile and others have pointed out already, we feel that the fish population of the Great Lakes is irrespective of State boundaries. A study of the biology of the fish of the Great Lakes is certainly an interstate and an international proposition, and naturally it has resulted in some reluctance on the part of individual States to go ahead with a very large research program.

Another item is the fact that the operation of the fish division of the Michigan Conservation Department is entirely from revenue obtained by selling fishing licenses, and it is a relatively small amount that comes in from commercial fishing licenses. Almost all the income is from sports fishermen, and those sports fishermen are paying for a license for fishing on inland water. There is not now required any license for sports fishing in the Great Lakes, so that quite naturally there has been some reluctance on the part of the States to do very much on the Great Lakes when practically none of their income at the present time is coming from the fisheries of that sort.

The CHAIRMAN. We have a license down in Alabama for sport fishing.

Do you say you have no license for the State?

Dr. COOPER. We have a State fishing license but it is not required to fish at Great Lakes.

The CHAIRMAN. Is there no license required to fish on the Great Lakes?

Dr. COOPER. No sport fishing license, no.

I may be a bit in error. I think a license is required to fish with boats. But most of the sports fishermen on the Lakes fish without a license.

The CHAIRMAN. What would be the take if you could get a license for that?

Dr. COOPER. I am not too sure. I would guess that there must be two or three hundred thousand people fishing the Great Lakes, sport fishing. We sell somewhat over a million fishing licenses for inland waters, and there probably would be two or three hundred thousand anyway who would fish.

The CHAIRMAN. All right. Are there any other States that do not charge for fishing, that have no licenses? I have to pay to fish in my own lake. I have 30 miles of lake on my place and when I go fishing I pay a dollar, I think, for a license.

Mr. POTTER. I think the doctor is referring to the sport fishing of the Great Lakes. A majority of the sport fishermen have a State license and the normal amount of sport fishing is in that water, where a license is required.

The CHAIRMAN. But I understood him to say there are about 300,000 sports fishermen who do not pay anything at all. I do not think anybody would mind paying a dollar to go fishing.

Dr. COOPER. That would be just a rough estimate. I would say that perhaps two or three hundred thousand fishermen fish in the Great Lakes.

The CHAIRMAN. Do they not pay any license to fish at all?

Dr. COOPER. A large number of them would also be buying a fishing license which entitles them to fish in inland waters.

The CHAIRMAN. But there are a number of them that do not pay for any license whatsoever.

Dr. COOPER. There are many thousands.

The CHAIRMAN. That is a good chance to get some revenue.

I might tell you that this year I had a group of men down from Chicago on my place, and I think we had 25 in the group. They paid, I think, $15 apiece—I have forgotten exactly what it was—to hunt deer and turkey. It certainly helps.

If you go fishing, I do not care what kind of fishing it is, I think you ought to have a license, whether it is out in the Gulf or anywhere you go. If the situation is as bad as we think it is, we are going to need an awful lot of help, and I think if we could tell the Congress that when we go to ask for this $500,000 for 3 years from now on, it would certainly help.

What about your State, Mr. Hand, as to fishing licenses?

Mr. HAND. Licenses are required both for intrastate and out-of-State fishermen, for all types of fishing, including clamming and taking crustaceans. But I doubt if a license is required to fish in the waters of the ocean. I am not sure about that. I doubt it.

The CHAIRMAN. What about your State, Mr. Allen?

Mr. ALLEN. We have a license.

The CHAIRMAN. What about Florida?

Mr. BENNETT. I think it is the same as yours. I think they allow a man to fish with one pole in his own county.

Dr. COOPER. I think Dr. Hile can tell us about the commercial fishing. What is their license?

Dr. HILE. It is variable, from State to State, depending on the size of the boat and the amount of gear. Then for a small rowboat it is just a flat fee. I don't think any two States have the same system of licensing.

The CHAIRMAN. Do not they pay any license fee at all?

Dr. HILE. I do not know all the States. I do not know any State on the Great Lakes that has a license for angling in the Great Lakes water.

Dr. COOPER. I think they have to have a license to catch bass in there.

Dr. HILE. Yes, sir; and lake trout trolling; just the operator of the boat. But the bulk of it, angling in the Great Lakes, is free.

Mr. HAND. What is the total revenue derived by the State of Michigan from all types of fishing licenses per year?

Dr. COOPER. About $2 million for sports fishing licenses, and the figure is around $60,000 from commercial fishermen.

Mr. ALLEN. Mr. Chairman, I have a question that has been bothering me, and it is this: Why is it that these States that have a joint problem do not get some type of interstate organization that can consider the problem and determine what the duties and benefits to the several States might be?

The other problem I have is, Why is it that Federal funds, which are a tax on all of the States, should be used for this investigation when a State like Michigan does not want to appropriate anything because they do not get it out of the fishing licenses?

I can see a lot of reason for doing it, but I would like to have something to go home with.

Dr. COOPER. I do not know any reason why, as you say, the Michigan Legislature does not make a general appropriation for that work.

Mr. HAND. Has it ever occurred to the Michigan Legislature to impose a tax on the gross value of the fish commercially caught in the State, for the purpose of raising funds to conduct research and other benefits to the industry?

Dr. COOPER. Their total income from commercial fishermen now, that $60,000, is relatively small in proportion to the actual expenses, and I think they are spending more than that now in the collection of statistics and law enforcement and some propagation, and so on, back to the fisheries in the Great Lakes.

Mr. HAND. In other words, your total income from commercial fishing licenses is about $60,000; is that right?

Dr. COOPER. That is right.

Mr. HAND. And some sports fishing and over all it is a figure of about $2 million.

Dr. COOPER. $2 million for sports fishing.

Mr. HAND. Alone?

Dr. COOPER. Yes.

Mr. HAND. And $60,000 for commerical fishing?

Dr. COOPER. That is right.

The question has been raised as to why we do not have a license for sports fishing in the Great Lakes. Of course, that proposal has been raised in the Michigan Legislature at least once, and perhaps oftener, and it has been turned down.

Apparently they feel that there should be something there that is still free.

Mr. HAND. I can understand the feeling. On the other hand, if there were a moderate license fee of $1, as the chairman suggests, for example, if, as you say, 300,000 fishermen fish there without licenses, that alone would be half the appropriation you are now seeking from the Congress, from one State.

Mr. VERDUIN. The only objection to this license has always come from the tourists and resort operators, who claim that sport fishing in the Great Lakes is one of the sporting attractions the State of Michigan has to offer and they therefore want to keep it free. Their argument for keeping it free is that it is not an expense to the State, that the fish that are taken by these sport fishermen on the Lakes are principally perch, which have never been in short supply and seem to be very prolific and maintain themselves without any expense to the State. So that has always been their objection.

Mr. POTTER. I would presume—and I think that the report if written on the bill, that when it comes to entering into the control phase of the program, then certainly such a program should be operated on an aid-to-State basis. However, it is difficult. You do have the problem where any State appropriating funds for research would either have to let it be directed pretty much by the Fish and Wildlife Service or else run the chance of parallel programs. That has happened in the past in other cases, and State legislatures are not too happy about appropriating funds for a Federal agency to do the administration.

So although there are problems, I think, as far as my own State is concerned, Michigan, you will find that the State of Michigan will participate in this much more, to a greater degree, than it has in the past. But I think a good point was raised by one of the other members, that they do not know just what to do at the present time and no State legislature wants to turn over funds to the Federal agency to administer the program for them.

Mr. ALLEN. I think that is all quite true.

I think, in addition, that here you have a problem which is very basic in a way, and a solution would add to the great body of scientific knowlege which is available to all the States, and possibly by solving this problem it will help to solve another problem. But when we come to that condition that you are now talking about, when the solution is found as the basis of control, that is something else.

Mr. POTTER. Yes; that is an entirely different matter.

Mr. ALLEN. I think it is, too. But I hope we do not continue with the same lack of coordination that exists now.

Mr. POTTER. I am assuming that the Fish and Wildlife Service, in making its recommendations on the conclusion of the research program, will recommend certain action to be taken by the States to carry out the recommendations.

Dr. Moffett, would you care to comment on that?

Dr. MOFFETT. Mr. Chairman, could I interject here?

The CHAIRMAN. You may; yes, sir.

Dr. MOFFETT. I might explain that there exists the Sea Lamprey Committee, which involves the Province of Ontario and all the States concerned, and also the Great Lakes Trout Committee, which involves all States in the Fish and Wildlife Service and the Province of Ontario. These committees function on a purely technical basis. They meet once a year. They issue a report, and I have brought sample copies of the report which was issued, for your inspection, and I would like to see that each one of you gets one.

We have discussed at great length this matter of implementing this lamprey program once the ways and means are found. The Michigan Legislature, the Committee on Fish and Fisheries called us today a year ago, or more than a year ago, to ask just what the State should do. We were not then in a position to advise them specifically because we did not know. I am satisfied that the States will take their share of this burden.

One of our major problems is the establishment of a body which can implement this control. The Fish and Wildlife Service, without any jurisdiction whatsoever on the water, will not be in a position to do so. We do not choose to do so because it would involve our telling the Province of Ontario and Canada in general what they should do, and, in turn, telling the States what they should do. As we see it, there must be some sort of a coordinating body with power to direct the effort, and all of the States and the Province of Ontario are actually interested in seeing that implemented.

There stands now before the Senate a treaty, the substance of which would allow the implementation of this lamprey program when it gets into the proper phase. Whether that is the answer or not, I am not prepared to say, but there will be a definite coordination necessary. I do not think you should feel that the Fish and Wildlife Service intends to take this entire burden upon itself.

Mr. HAND. But in this suggested legislation, I suppose that you are assuming the entire burden, at least momentarily.

Dr. MOFFETT. At this juncture, I think that is true.

Mr. HAND. So if you did get some definite hope of implementation on the part of the States and the Dominion, it follows that we might not need to authorize as much money as has been suggested in this legislation; is that not true?

Dr. MOFFETT. Our request for a $500,000 authorization does not necessarily mean that over the years we will ask for $500,000.

Mr. HAND. Let me ask you this question at that point: Suppose this committee says, "Well, we think that the States ought to do something about this; but, on the other hand, there is some Federal problem involved and we are going to authorize, subject to the almighty Appropriations Committee, an additional amount of money," and suppose we might go further and say we are inclined to give you $500,000. But then suppose we went one step further and say, "But we are not going to appropriate $500,000 for each of the five succeeding fiscal years; on the contrary, we are going to appropriate $500,000 for the next fiscal year and then we are going to ask you people to come back and tell us what you have been able to do." Would anything like that result in hampering your program? I am speaking purely speculatively and talking only for myself, thinking out loud. Would that in any way hamper your program?

Dr. MOFFETT. I think, gentlemen, you will find that our reason for coming here is that our program started out in a small way and has generated to the point where we need expansion. One of the reasons for that expansion is this: that the research efforts have always been criticized because of the time necessary to consumate them. We feel there is a very pressing need for speed in this thing. We want to get it over with as rapidly as possible so that something can be done about the lamprey.

And when we ask for a ceiling or an authorization of $500,000, I hope you will have the confidence in us to know that if we do not need $500,000 we will not ask for it.

One thing that is so uncertain in a research program is that we cannot fix amounts. We may take one direction this day and 5 months later take another direction, which entirely reorients our program.

For example, I was so certain that we could economically kill the downstream migrating phase of the lamprey that I felt we had this thing solved. It turned out that we could not. They were highly resistant. That meant we had to reorient our entire program and bring into reality phases of the situation that were under consideration but not actively implemented and start in another direction. We work in the unknown, in other words, and we would like to have at least an adequate ceiling on our ability to ask for money to cover any exigencies.

Mr. HAND. You would like to have some assurance of continuity, too, because you cannot say if you have done a satisfactory job at a certain time.

Mr. POTTER. On the other hand, if the committee is going to give $500,000 to you for another year and then have you come back and talk to us about this thing, would that hamper your present investigation; and if so, how?

Dr. MOFFETT. It would not hamper our investigation seriously. It would not hamper our effort. The only thing is that we have to make these repeated requests. We feel that we might be criticized for coming in and saying we want so much money this year and then next year we come back and say we would like to get the authorization raised, and then come back again the next year. You get tired of listening to us.

Mr. HAND. In a matter like this, though, there is some sense in the committee's taking another look at it to see what progress has been made in a year's time.

Dr. MOFFETT. Yes. I think we ourselves would welcome that at any time, and I am sure the Service would as well.

Mr. POTTER. Along that line, could I interject something?

I think it is very worth while for the Fish and Wildlife Service to report to the committee, regardless of whether or not this bill becomes law, as to the efforts they put forth during the past year. But in limiting the authorization to 1 year there is the fact to consider that in preparing their budget, if this bill should just go into effect for 1 year, then the following year they would have to prepare a budget possibly for more than the amount that was already authorized.

Then there is the matter of timing, and we who have been on the committees know that many times we hold up Federal agencies a great deal by not knowing what their program is going to be for the ensuing year.

But I think it will certainly be worth while to require that they report to the committees of Congress annually, as you have done now. By so doing, their authorization can always be cut down if it is deemed necessary in the light of the report. Certainly, the Appropriations Committee will see to it that the funds are not used injudiciously.

I might say that they have had a good record in the first year's authorization. They did not take all of it. A good share of it was left in the Treasury because they did not need it. I think that speaks well for the Service.

The CHAIRMAN. That is very unusual.

Dr. MOFFETT. Could I just give you the history on that? Mr. Day referred to it in his remarks.

The original request was for approximately $359,000. We asked for and received $259,000 the first year and we were authorized $216,000 for subsequent years, and we have never broken $200,000 since.

The CHAIRMAN. Thank you, sir.

Have you finished, Dr. Cooper?

Dr. COOPER. Yes.

The CHAIRMAN. Are there any other witnesses?

Thank you very much, gentlemen.

The committee is adjourned.

(Whereupon, at 12:45 p. m., Monday, April 30, 1951, the hearing was adjourned.)

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